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Briggs AM, *et al. BMJ Global Health* 2021; 6:e006045. doi: 10.1136/bmjgh-2021-006045

SUPPLEMENTARY FILE 1

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Supplementary file 1

GRIPP2 short form[1]

Section and topic	Item	Reported on page No
1: Aim	Report the aim of PPI in the study	13
2: Methods	Provide a clear description of the methods used for PPI in the study	13
3: Study results	Outcomes—Report the results of PPI in the study, including both positive and negative outcomes	20-23, Tables 1 and 2
4: Discussion and conclusions	Outcomes—Comment on the extent to which PPI influenced the study overall. Describe positive and negative effects	24-29
5: Reflections/critical perspective	Comment critically on the study, reflecting on the things that went well and those that did not, so others can learn from this experience	28-29

PPI=patient and public involvement

Reference

1. Staniszewska S, Brett J, Simera I, et al. GRIPP2 reporting checklists: tools to improve reporting of patient and public involvement in research. BMJ (Clinical research ed 2017;358:j3453.

Supplementary file 2

SUPPLEMENTARY FILE 2

Supplementary file 2

Recommendations for the Conducting and REporting of DElphi Studies (CREDES)[1].

"YES" infers the quality criterion has been met in the current study.

Rationale for the choice of the Delphi technique

1. Justification. The choice of the Delphi technique as a method of systematically collating expert consultation and building consensus needs to be well justified. When selecting the method to answer a particular research question, it is important to keep in mind its constructivist nature. YES

Planning and design

2. Planning and process. The Delphi technique is a flexible method and can be adjusted to the respective research aims and purposes. Any modifications should be justified by a rationale and be applied systematically and rigorously. NOT APPLICABLE
3. Definition of consensus. Unless not reasonable due to the explorative nature of the study, an a priori criterion for consensus should be defined. This includes a clear and transparent guide for action on (a) how to proceed with certain items or topics in the next survey round, (b) the required threshold to terminate the Delphi process and (c) procedures to be followed when consensus is (not) reached after one or more iterations. YES

Study conduct

4. Informational input. All material provided to the expert panel at the outset of the project and throughout the Delphi process should be carefully reviewed and piloted in advance in order to examine the effect on experts' judgements and to prevent bias. YES
5. Prevention of bias. Researchers need to take measures to avoid directly or indirectly influencing the experts' judgements. If one or more members of the research team have a conflict of interest, entrusting an independent researcher with the main coordination of the Delphi study is advisable *Consolidated criteria for reporting qualitative research **Consolidated Standards of Reporting Trials 702 Palliative Medicine 31(8). YES
6. Interpretation and processing of results. Consensus does not necessarily imply the 'correct' answer or judgement; (non)consensus and stable disagreement provide informative insights and highlight differences in perspectives concerning the topic in question. YES
7. External validation. It is recommended to have the final draft of the resulting guidance on best practice in palliative care reviewed and approved by an external board or authority before publication and dissemination. YES

Reporting

8. Purpose and rationale. The purpose of the study should be clearly defined and demonstrate the appropriateness of the use of the Delphi technique as a method to achieve the research aim. A rationale for the choice of the Delphi technique as the most suitable method needs to be provided. YES
9. Expert panel. Criteria for the selection of experts and transparent information on recruitment of the expert panel, sociodemographic details including information on

expertise regarding the topic in question, (non)response and response rates over the ongoing iterations should be reported. YES

10. Description of the methods. The methods employed need to be comprehensible; this includes information on preparatory steps (How was available evidence on the topic in question synthesised?), piloting of material and survey instruments, design of the survey instrument(s), the number and design of survey rounds, methods of data analysis, processing and synthesis of experts' responses to inform the subsequent survey round and methodological decisions taken by the research team throughout the process. YES
11. Procedure. Flow chart to illustrate the stages of the Delphi process, including a preparatory phase, the actual 'Delphi rounds', interim steps of data processing and analysis, and concluding steps. YES
12. Definition and attainment of consensus. It needs to be comprehensible to the reader how consensus was achieved throughout the process, including strategies to deal with non-consensus. YES
13. Results. Reporting of results for each round separately is highly advisable in order to make the evolving of consensus over the rounds transparent. This includes figures showing the average group response, changes between rounds, as well as any modifications of the survey instrument such as deletion, addition or modification of survey items based on previous rounds. YES
14. Discussion of limitations. Reporting should include a critical reflection of potential limitations and their impact of the resulting guidance. YES
15. Adequacy of conclusions. The conclusions should adequately reflect the outcomes of the Delphi study with a view to the scope and applicability of the resulting practice guidance. YES
16. Publication and dissemination. The resulting guidance on good practice in palliative care should be clearly identifiable from the publication, including recommendations for transfer into practice and implementation. If the publication does not allow for a detailed presentation of either the resulting practice guidance or the methodological features of the applied Delphi technique, or both, reference to a more detailed presentation elsewhere should be made (e.g. availability of the full guideline from the authors or online; publication of a separate paper reporting on methodological details and particularities of the process (e.g. persistent disagreement and controversy on certain issues)). A dissemination plan should include endorsement of the guidance by professional associations and health care authorities to facilitate implementation. NOT APPLICABLE.

Reference

1. Junger S, Payne SA, Brine J, Radbruch L, Brearley SG. Guidance on Conducting and REporting DElphi Studies (CREDES) in palliative care: Recommendations based on a methodological systematic review. Palliative Medicine 2017;31:684-706.

Supplementary file 3

SUPPLEMENTARY FILE 3

Supplementary file 3

Inclusion criteria Phase 1

- Ability to read and speak English
- Meet one or more of the sampling criteria below
    - A President/Chair, Vice President or appropriately delegated senior-level official (e.g. leader of a special interest group or subcommittee) of an international or global clinical/professional organisation relevant to musculoskeletal health and/or persistent pain care and have held this post for at least 12 months.
    - A President/Chair, Vice President or appropriately delegated senior-level official of an international or global advocacy (including patient advocacy) organisation relevant to musculoskeletal health, persistent pain care, injury, ageing, non-communicable diseases or health systems strengthening and have held this post for at least 12 months.
    - An official of the World Health Organization whose scope of work is relevant to musculoskeletal health, ageing and lifecourse or non-communicable diseases and who have held this post for at least 12 months.
    - A senior officer in a national Ministry of Health holding a position for at least 12 months that includes international activities in health system strengthening efforts (i.e. beyond a single national context).
    - A thought leader in musculoskeletal health and/or persistent pain health policy or health system reform, defined by publication of at least 3 peer-reviewed journal papers or health policies in the last 5 years that have a focus on health system reform or health policy relevant to musculoskeletal health or persistent pain care.
    - A person with a lived experience of a musculoskeletal health condition and/or persistent musculoskeletal pain for more than 5 years.

Supplementary file 4

SUPPLEMENTARY FILE 4

Supplementary file 4

Phase 1: Interview questions

1. How would you describe the current state of musculoskeletal (MSK) healthcare (both prevention and management) globally?

2. In your opinion, what needs to be done now to improve the prevention and management of MSK conditions at a global level?

3. Global Strategies or Action Plans are often used, e.g. by the WHO, to draw attention and action to important health issues. Do you see value in a Strategy or Action Plan to guide a global response to improve MSK conditions?

4. What would you want to see in a global Strategy for the Prevention and Management of MSK health?
    - What should be the goals of the Strategy?

5. The WHO Global Action Plan for Prevention and Control of NCDs (2013-2020) is framed around 6 objectives. I would like you to reflect on each objective and discuss it in the context of MSK conditions.

    a. **Objective 1 is Prioritisation and advocacy**: Raise the priority of prevention and control of NCDs in global, regional and national agendas and internationally agreed development goals, through strengthened international cooperation and advocacy.
        - What would you consider to be the specific priorities to improve prevention and management of MSK conditions?

    b. **Objective 2 is Country-level system strengthening**: For individual countries to strengthen national capacity, leadership, governance, and multi-sectoral action to accelerate responses for the prevention and control of NCDs through areas such as policy, workforce and financing.
        - What would you consider to be the specific opportunities to improve prevention and management of MSK conditions at a country-level? What would be specific opportunities/priorities in the areas of:
            - National leadership
            - Citizen engagement
            - Policy
            - Workforce capacity-building
            - Financing

    c. **Objective 3 is Risk factors and determinants**: To reduce modifiable risk factors for NCDs and underlying social determinants through creation of health-promoting environments.
        - What should be the priorities in reducing modifiable risk factors for MSK conditions?

d. **Objective 4 is Primary care services and universal health coverage**: To strengthen and orient health systems and services to address the prevention and control of NCDs and the underlying social determinants through people-centred primary health care and universal health coverage.
    - What would you consider to be the specific priorities to improve the prevention and management of MSK conditions in relation to primary care services and universal health coverage? In particular, please consider:
        i. Service models (or 'models of care') and workforce
        ii. Access to essential medicines/technologies

e. **Objective 5 is Research and innovation**: To promote and support national capacity for high-quality research and development for the prevention and control of NCDs.
    - What would you consider to be the specific priorities to improve the prevention and management of MSK conditions in relation to research and innovation?

f. **Objective 6 is Surveillance:** To monitor the trends and determinants of NCDs and evaluate progress in their prevention and control, such as population health surveillance reporting and health information systems.

    - What would you consider to be the specific priorities to improve the prevention and management of MSK conditions in relation to population health surveillance reporting and health information systems?

6. Do you think any of these elements relate differently to high income and low to middle income countries?

SUPPLEMENTARY FILE 5

Supplementary file 5

Search Strategy – Policy Scoping Review

Step 1. Desktop Internet search.
A systematic search for policies in the most 30 most populated countries was performed using Google from 01 July 2020 to 15 Aug 2020 for each country. Countries were identified by population size using UN World Population Prospects. Search terms for musculoskeletal condition descriptors used to identify organisations for Phase 3 (see Supplementary file 8) were supplemented with the search terms ["policy OR strategy OR action plan OR strategic framework OR health indicators"] along with a country name to locate potential national policy documents. Often, a combination of these search terms would lead to the webpage of a government agency or department relevant to MSK health or chronic pain, where hand searching of the entire website for relevant documents was performed. In addition, hand searching of other linked government agencies webpages was also performed. Finally, reference lists of retrieved policy documents were hand searched for additional documents relevant to MSK health and chronic pain policy.

In addition to searching in English, contacts with experience in MSK health and ability to read in the native languages of the included countries performed searches on Google using native language search terms during the same period. Contacts were instructed to utilize similar search terms, web page searching, linked webpage searching, and reference list screening. Contacts from countries not included in the top 30 most populous nations were also asked to identify any potentially relevant documents they were aware of.

Step 2. Input from G-MUSC supporters and networked experts. An email request was sent to experts known to the research team and G-MUSC International Coordinating Council. The request was deliberately broad to enable the experts to submit policies that could fit any of the potential criteria for inclusion in the analysis and was set as:

i. National, or multi-national level policies
ii. Government issued – or co-sponsored (e.g. professional associations publishing together with government Ministries or Departments)
iii. Labelled as 'policy', 'strategy', 'framework', 'action plan' or similar
iv. Focussed specifically on MSK health, MSK pain, or a specific MSK condition.

Step 3. Snowballing. Where documents collated via methods 1 and 2 made reference or mention to other relevant policies (e.g. international documents referencing in-country documents) these were hand searched and added to the total document pool. Therefore, at this stage, multi-national or regional documents could be included.

Supplementary file 6

SUPPLEMENTARY FILE 6

Supplementary file 6

Inclusion criteria for policy document scoping review

2) government issued; published by official government departments; or explicitly endorsed by government departments as representing the policy of a specified jurisdiction;
3) targets population-level improvement in musculoskeletal health; or containing a substantial section/chapter dedicated to musculoskeletal health (general) or any of the following sub-areas: pain, rheumatic conditions, injury (including occupational, but excluding injury prevention);
4) contains jurisdiction-wide strategies, action plans or system-level Models of Care or Models of Service Delivery – further defined as a document including a care pathway that includes prevention, diagnosis, treatment, rehabilitation and recovery and the roles played by different providers within the pathways, their roles responsibilities; and information on how the different providers connect.
5) Current version (if regularly updated) and a publication/coverage date not older than 2010.

SUPPLEMENTARY FILE 7

Supplementary file 7

Sampling categories for Phase 3

- A person with a lived experience of a musculoskeletal health impairment (musculoskeletal condition, musculoskeletal pain, musculoskeletal injury) for at least 5 years.
- A registered clinician or other health worker, working in musculoskeletal health, pain care or injury care for at least 5 years.
- An officer of a clinical/professional organisation relevant to musculoskeletal health, pain care or injury care and have held this post for at least 12 months.
- An individual currently involved in global or national health policy, service design or service implementation related to musculoskeletal health, musculoskeletal pain, injury, non-communicable disease, ageing, disability or rehabilitation for at least 2 years.
- An individual currently involved in advocacy (including patient advocacy) in the context of musculoskeletal health, musculoskeletal pain, injury, non-communicable disease, ageing, disability or rehabilitation for at least 2 years.
- A thought leader, defined as an individual who has published at least 2 peer-reviewed papers or health policies in the last 5 years related to global health system or health service reform for musculoskeletal health, musculoskeletal pain, injury, non-communicable disease, ageing, disability or rehabilitation.
- An individual holding an academic (e.g. research or teaching) or workforce training position(s) related to musculoskeletal health, musculoskeletal pain, injury, non-communicable disease, ageing, disability or rehabilitation for at least 2 years.
- An officer of the World Health Organization.
- An officer of a national or sub-national Ministry of Health.

Supplementary file 8

SUPPLEMENTARY FILE 8

Supplementary file 8

Systematic desktop search for clinical organisations

1.1 Step 1: identify country names for the top 30 most populated countries, based on on UN population estimates for 2020, derived from the UN World Population Prospects 2019 dataset.

- The country name was modified as per country for example – Ethiopian, Spanish, German, Iranian, Thai, British
- Regions were also searched where a country-specific organisation was not identified; like African, Asian
- Capital city names were used within a country where the organisation could not be identified.

1.2 Step 2: identify clinical organisations

- An advanced Google search was performed with a combination of descriptive keywords (see search terms below).
- Where an international organisation was identified, it was used it to identify country-level society/associations.
- The 'Translate to English' function on Google Chrome was used for countries where an English (EN) version of the website was not available.

1.3 Step 3: identify contact email address

- Searched for Organisation chart/Leadership team/Executive committee/Committee/Executive Board/Board of Directors within the organisation's website identified in Step 2.
- Searched for President/Director/Operations/Head/Admin
- Searched for the presentation of the president/director identified on SlideShare or WHO for email addresses
- Searched LinkedIn, Twitter/ university details if any to identify email addresses.
- Used email search software where required to identify email addresses
- Used common generic email address when no person-specific contact address found

Search terms by clinical discipline

Rheumatology
Rheumatology+Association+Society + Country name
Rheumatism+ Association+Society + Country name
Arthritis+ Association+Society + Country name
Musculoskeletal+ Association+Society + Country name
All of the above + region name + any city name (when country-specific not identified)
International organisation site: International League of Associations of Rheumatology
http://www.ilar.org/partners/

Orthopaedics

Supplementary file 8

Orthopaedics+Association+Society + Country name
Orthopaedics Specialist+ Association+Society + Country name
Orthopaedics Department+ Hospital+ Society + Country Name
Orthopaedics + Publications+ Country name - Searching author names from respective country
All of the above + region name + any city name (when country-specific not identified)
International organisation site: SICOT (Société Internationale de Chirurgie Orthopédique et de Traumatologie) https://www.sicot.org/about-sicot

Pain Medicine
Pain+ Association+Society + Country name
Pain + Chapters+ IASP+ Country name
Anaesthesiology+ Pain+ country when no other contact of pain identified
All of the above + region name + any city name (when country-specific not identified)
International organisation site: International Association for the Study of Pain https://www.iasp-pain.org/

Paediatrics/Adolescent health
Paediatrics+ Association+ Country name
Paediatrics+ Society+ Country name
Paediatric+ Country name+ publications - Searching author names from respective country
All of the above + region name + any city name (when country-specific not identified)
International organisation site: International Paediatric Association https://ipa-world.org/page.php?id=326

Rehabilitation
Rehab+ Rehabilitation+ Association+ Country name
Rehab+ Rehabilitation + Country + Publication
All of the above + region name (when country-specific not identified)

Gerontology/Geriatrics
Geriatrics+ Society+ Country name
Gerontology+ Association+ Society+ Country name
Geriatrics+ Publication+ Country name
All of the above + region name (when country-specific not identified)

Physiotherapy
Physio+ association + Society+Country name
Physical Therapy+ Society + Country name
Physiotherapy+ Association+ Country name
All of the above + region name (when country-specific not identified)
International organisation site: World Physiotherapy https://world.physio/

Chiropractic
Chiropractor+ society + Country name
Region name + Chiropractor+ Association
Capital city name+ Chiropractor+ Association

Supplementary file 8

International organisation site: International Chiropractor Association
https://www.chiropractic.org/about/
International organisation site: Chiropractic Diplomatic Corp
https://www.chiropracticdiplomatic.com/?s=ethiopia

Systematic desktop search for civil society (patient advocacy) organisations

A comprehensive search in English was performed using Google from 20 Aug 2020 to 01 Sep 2020 for each country identified at 1.1 above. A combination of search terms (see box below) along with country name was used to locate potential patient/consumer organizations. Webpages were searched for contact information and other linked organizations relevant to MSK health, in line with 1.2 and 1.3 above.

In addition to desktop searching, known contacts with experience in MSK health and ability to read in the native languages of the included countries performed searches on Google using native language search terms during the same period. These individuals were instructed by to utilize the same search terms, web page searching, and linked webpage searching to the English language search.

Search terms
Arthritis
Rheumatoid arthritis
Osteoarthritis
Low back pain
Neck pain
Spinal pain
Ankylosing spondylitis
Osteoporosis
Fracture
Musculoskeletal disorders
Foundation
Society
Organization
Patient advocacy
Patient group
Awareness

SUPPLEMENTARY FILE 9

Delphi Survey Round 1

Default Question Block

Empirical development of prioritised components for a global strategy for improving musculoskeletal health

Thank you for your interest in participating in this research, undertaken in partnership with the Global Alliance for Musculoskeletal Health. This phase of the research uses an eDelphi method to collect feedback from a global panel of multi-sectoral stakeholders on possible components for a global strategy for improving musculoskeletal health, including musculoskeletal pain and injury.

An Information Statement about the research is available here for download. You should review and retain this Statement before proceeding. The next screen will ask for your consent to participate.

Curtin University Human Research Ethics Committee (HREC) has approved this study (HRE2020-0183).

The time commitment to complete this survey is approximately 30 minutes (range 20-40min). You do not have to complete the survey in one sitting. As long as you use the same computer or device, you can return to the survey at any time. The survey remains open until 3rd November 2020.

Consent to participate

I have read the Participant Information Statement and I understand its contents.

- **I believe I understand the purpose, extent and possible risks of my involvement in this project.**
- **I voluntarily consent to take part in this research project.**
- **I have had an opportunity to ask questions and I am satisfied with the answers I have received.**
- **I understand that this project has been approved by Curtin University Human Research Ethics Committee and will be carried out in line with the Australian National Statement on Ethical Conduct in Human Research (2007).**
- **I understand I can save a copy of the Participant Information Statement and Consent Form.**

Participation

○ I consent to participate in this research.

○ I do not consent to participate in this research.

Participation in Phase 1 of this study

Did you participate in an earlier phase of this research, specifically a telephone/videoconference interview with a member of the research team?

○ Yes

○ No

Thank you for confirming you participated in Phase 1 of this research project.

Please enter your email address (for linking with your previous data and to contact you for the next Delphi round).

Email address: _____ 24

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Do you consent to the demographic data you provided in Phase 1 being linked to your responses to this Phase of the project? This will reduce the number of demographic questions presented to you in this survey.

- ○ Yes
- ○ No

Eligibility screening

To participate in this phase of the research, you must meet one or more of the following criteria. Please select which criteria apply to you (you may select more than one).

I am:

- ☐ A person with a lived experience of a musculoskeletal health impairment (musculoskeletal condition, musculoskeletal pain, musculoskeletal injury) for at least 5 years.
- ☐ A registered clinician or other health worker, working in musculoskeletal health, pain care or injury carefor at least 5 years.
- ☐ An officer of a clinical/professional organisation relevant to musculoskeletal health, pain care or injurycare and have held this post for at least 12 months.
- ☐ An individual currently involved in global or national health policy, service design or service implementation related to musculoskeletal health, musculoskeletal pain, injury, non-communicable disease, ageing, disability or rehabilitation for at least 2 years.
- ☐ An individual currently involved in advocacy (including patient advocacy) in the context of musculoskeletal health, musculoskeletal pain, injury, non-communicable disease, ageing, disability orrehabilitation for at least 2 years.
- ☐ A thought leader, defined as an individual who has published at least 2 peer-reviewed papers or healthpolicies in the last 5 years related to global health system or health service reform for musculoskeletal health, musculoskeletal pain, injury, non-communicable disease, ageing, disability or rehabilitation.
- ☐ An individual holding an academic (e.g. research or teaching) or workforce training position(s) related to musculoskeletal health, musculoskeletal pain, injury, non-communicable disease, ageing, disability or rehabilitation for at least 2 years.
- ☐ An officer of the World Health Organization.
- ☐ An officer of a national or sub-national Ministry of Health.
- ☐ None of the above.

Demographic information

Please provide your contact email address.

This is required so we may contact you for the next Delphi round. To preserve anonymity, your email address will not be stored with your responses.

Email address: _____

Please select your year of birth

_____ ▾

Please specify your gender

- ○ Male
- ○ Female

Supplementary file 9

- ○ Non binary
- ○ Prefer not to disclose

Demographic information continued

In which country do you usually reside?

Please indicate your highest level of education:

- ○ Primary/elementary school Secondary/high
- ○ school Diploma/certificate/apprenticeship
- ○ University bachelor degree
- ○ University higher degree other than Masters or PhD
- ○ University higher degree (Masters)
- ○ University higher degree (PhD)
- ○

You indicated you are a registered clinician or other health worker, working in musculoskeletal health, pain care or injury care for at least 5 years.

Please select your primary discipline from the list below:

Discipline

You selected 'other' to describe your primary discipline. Please state your discipline.

Clinical practice

Please select the option that best reflects your primary place of practice:

- ○ I am not a registered clinician/health worker.
- ○ I am a registered clinician/health worker but I do not practice clinically.I
- ○ primarily practice in a community/primary care setting (not hospital). I
- ○ primarily practice in a non-tertiary hospital setting .
- ○ I primarily practice in a tertiary hospital setting.
- ○ I primarily practice in an academic clinical setting.I
- ○ primarily practice in a different setting.

What is the total number of years of your professional experience in any aspect of healthcare (excluding training)?

Please state number only

You indicated that you have had a musculoskeletal health condition, persistent musculoskeletal pain and/or musculoskeletal injury for more than 5 years.

For the purposes of this research, could you please advise the number of years that you have lived with your condition(s).

[please state number only]

Please indicate if you are responding to this Delphi survey as an individual or as a representative for an organisation(s).

Supplementary file 9

○ Individual
○ Organisation

Please indicate the name(s) of the organisation(s) you are representing:

Organisation 1	
Organisation 2	
Organisation 3	
Organisation 4	

Delphi items

The Delphi items are presented in 8 categories. Each category contains a list of items which relate to possible components for a global strategy to improve the prevention and management of musculoskeletal health.

For each item, you will be asked to assign your perceived level of importance using a scale from 1 (not at all important) to 9 (extremely important). A 'don't know' option is also available.

The items presented have been derived from in-depth qualitative interviews with 31 global leaders (including patients and advocacy organisations) and a scoping review of national health policies.

Each Delphi item is written as a brief statement, summarising rich information collected from the earlier phases of the project. To assist with interpretation of the items, a Guidebook has been prepared that provides further detail underpinning each item in the form of a more detailed commentary. It is recommended that you refer to the Guidebook where you feel that further information about the intent and scope of an item is needed.

Download the Guidebook here.

Please note: Musculoskeletal (MSK) health includes musculoskeletal conditions, musculoskeletal pain (e.g. back or neck pain) or musculoskeletal injury/trauma.
Musculoskeletal conditions include any condition that affects the muscles, bones or joints (e.g. arthritis, gout, osteoporosis, sarcopenia, auto-immune conditions).

Category 1: Engaging, empowering and educating citizens, communities, organisations and governments to act on MSK health

Priority sectors

1.1 Priority sectors for pursuing engagement and forging partnerships to support prevention and management of MSK health include:

	1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
Citizens, patients and civil society organisations.	○	○	○	○	○	○	○	○	○	○
Industry, workplaces and employers.	○	○	○	○	○	○	○	○	○	○
Third party payers and insurers.	○	○	○	○	○	○	○	○	○	○
Built environment sector (urban planners and developers of residential and commercial buildings,open space planners, transport and road safety systems).	○	○	○	○	○	○	○	○	○	○
Schools and higher education facilities.	○	○	○	○	○	○	○	○	○	○
National and sub-national governments.	○	○	○	○	○	○	○	○	○	○

Supplementary file 9

Priority areas for public education

1.2 Education about MSK health that should be widely communicated includes:

- the importance of MSK health to human function and participation across the life-course;
- how to maintain MSK health and prevent MSK injury;
- a contemporary understanding of pain; and
- impacts of impaired MSK health.

These educational messages should be disseminated to: schools and higher education facilities; workplaces and employers; health professionals and the community at large.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Priority messages for public health education about MSK health

1.3 Disseminate consistent, high-priority public health messages for MSK health prevention and management that are globally relevant and can be appropriately contextualised to local settings.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Priority enablers to drive advocacy and support community-wide education

1.4 Use globally-relevant mechanisms to drive advocacy and deliver community-wide education about MSK health through:

- **empowering people with lived experience to share stories and co-design messages**
- **using mass and social media**
- **adopting peer support models**
- **supporting civil society and professional organisations.**

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Category 2: Leadership, governance and shared accountability

Integration with existing policy and system strengthening reforms (3 items)

2.1 MSK health conditions and MSK pain need to be more explicitly integrated with broader non-communicable disease (NCD) reform efforts in policy, resourcing and service planning by national governments. This is to ensure:

i) they are recognised as critical NCDs

ii) to harness the shared risk factors and management strategies between MSK health conditions and other NCDs.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Integration with existing policy and system strengthening reforms continued

2.2 Policy and resourcing decisions for Universal Health Coverage (UHC) essential care packages and/or insurance schemes should include healthcare for MSK health conditions, pain and injury due to the associated disability burden, especially in the context of co-morbidity with other NCDs.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Integration with existing policy and system strengthening reforms continued

2.3 A global strategy for MSK healthcare, pain and injury should explicitly link with and support implementation of existing global and national efforts in health system strengthening, for example primary care integration, ageing, rehabilitation, NCD care and injury and trauma prevention and management.

Supplementary file 9

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Global and national leadership to prioritise MSK health, pain and injury prevention and care (4 items)

2.4 Global leadership from the World Health Organization (WHO) in prioritising MSK health is essential to catalyse a global response to the burden of MSK disease, particularly in low and middle-income countries and to inform strategic activities of global clinical organisations. Leadership would take the form of the development of a Strategy, Action Plan or Guideline.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Global and national leadership to prioritise MSK health, pain and injury prevention and care continued

2.5 National leadership is needed in each country to advocate for higher prioritisation of MSK health by governments and for governments to work collectively to advocate for the World Health Organization (WHO) to act on MSK health globally.

In order for national governments to respond to MSK health, there is a need to inform them about the human capital and economic benefits (e.g. return on investment) of acting on MSK-related disability prevention and management.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Global and national leadership to prioritise MSK health, pain and injury prevention and care continued

2.6 Leadership from professional and civil societies and citizens that extends beyond just MSK health, pain and injury care is needed.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

2.7 Global and national multi-sectoral and inter-ministerial leadership with dedicated responsibility within health ministries for MSK health is needed to prioritise action on policy and financing for MSK health.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Measurement and classification (2 items)

2.8 Health indicators and performance measures must extend beyond mortality reduction and consider function and participation (or disability prevention).

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

2.9 A meaningful, acceptable and internationally comparable classification system is needed for MSK health to appropriately plan policy, health services and care pathways and financing reforms.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Supplementary file 9

Legislation and regulation

2.10 Legislation and regulation are needed to sustain reform efforts in health system strengthening for non-communicable diseases, including MSK health and to mitigate changes in priorities as governments change.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Category 3: Financing

Integrated financing models

3.1 Existing healthcare financing models need to accommodate health promotion and health care delivery for MSK health. This may be achieved through integrated financing for health promotion, non-communicable disease care, injury and trauma care or ageing and long-term care.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Flexibility for different financing models (3 items)

3.2 Financing models for MSK health promotion and care should accommodate the flexibility for public-private partnerships, partnerships with civil society, international aid, tagged donorships and revenue-raising strategies, such as taxes for condition-specific care (e.g. injury and trauma care).

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Flexibility for different financing models continued

3.3 Support multi-national foreign aid for MSK care in low resource settings and where priority for MSK health financing is low.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Flexibility for different financing models continued

3.4 Financing models should enable protection of allocated funding or donor funds for MSK health and injury care as well as quarantined funds for essential medicines.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Financing for the right care, by the right team, in the right place (2 items)

3.5 Healthcare financing should be directed towards well defined, high-value (effective, safe, affordable) packages of care for prevention, diagnostics, and management of MSK health conditions and injury within Universal Health Coverage packages and/or other insurance systems, particularly for community-based interventions.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

3.6 Financing models should incentivise prevention and integrated inter-professional care for MSK health conditions

1 (not at all	2	3	4	5	6	7	8	9 (extremely	Don't know

important) important)

Supplementary file 9

Category 4: Service delivery

Care at the right time: early diagnosis, triage and intervention for secondary prevention

4.1 Service models for MSK conditions need to support early diagnosis and triage through appropriate assessment and timely initiation of effective treatments aligned to locally-supported care pathways.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Delivery of the right care: effective, safe, affordable and accessible (4 items)

4.2 Formulate local care pathways based on essential packages of affordable, effective and safe care for MSK health conditions, pain and injury while disinvesting in care that is not supported by evidence, is high cost and potentially harmful.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Delivery of the right care: effective, safe, affordable and accessible continued

4.3 Services for MSK health conditions, pain care and injury care should be integrated with existing service models for non-communicable disease (NCD) care and service initiatives that target the broader social determinants of health.

This integration is needed to reduce the impact of MSK co-morbidities in NCD care, reduce the risk of developing other NCDs and enable participation in active rehabilitation for NCDs.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Delivery of the right care: effective, safe, affordable and accessible continued

4.4 Best practice diagnostic investigations and therapeutic interventions should be prioritised in service models over approaches that are not supported by evidence, are high cost and potentially harmful.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

4.5 Service models for MSK conditions should support integrated, person-centred care that targets functional ability and participation through a more contemporary understanding of pain.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Delivery of care from the right team: interprofessional service models

4.6 Service models for MSK healthcare should promote community-based interprofessional care, grounded on common standards of MSK care delivery across healthcare providers.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Delivery of care in the right place: bolstering community and primary care to reduce inequity in access to care (3 items)

4.7 MSK care should be integrated into existing community- or regionally-based service models for non-communicable disease care to reduce inequity in access, integrate care across different health conditions and service providers, and build capacity in the existing workforce.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Delivery of care in the right place: bolstering community and primary care to reduce inequity in access to care continued

4.8 Community-led service models for MSK healthcare should be co-designed by the community to ensure services are aligned with community needs and are appropriate, acceptable, feasible and sustainable.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

4.9 Service models should prioritise access to health information and care to vulnerable groups to mitigate care disparities.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Prevention (3 items)

4.10 Primary and secondary prevention initiatives for non-communicable diseases should integrate MSK health conditions and pain care, based on common shared risk factors and frequent co-morbidity between conditions.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

4.11 MSK-specific primary prevention initiatives should be promoted and implemented where evidence of clinical and cost effectiveness exists.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Prevention continued

4.12 National injury (sport, workplace, falls) and trauma prevention strategies and campaigns are needed to reduce the disability burden associated with MSK-related injury and trauma.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Category 5: Equitable access to medicines and technologies

5.1 Countries need to identify and resource essential therapeutics for priority MSK conditions, particularly in the context of pandemics and consider mechanisms to improve access to medicines and effective therapies to reduce inequity in access to care.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

5.2 There is a need to prioritise innovation in development of, and access to, low cost assistive devices and technologies (e.g. digital technologies, joint replacement surgery) to support function, especially in low and middle-income settings.

1	2	3	4	5	6	7	8	9	Don't know

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(not at all important)								(extremely important)	
○	○	○	○	○	○	○	○	○	○

Category 6: Workforce - building workforce capacity, systems and tools

Workforce volumes and access (3 items)

6.1 Increase the number of medical specialists for MSK healthcare in low and middle-income settings. Depending on local workforce volumes and distributions, increasing workforce volumes for allied health professionals may also be relevant.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

6.2 Build capacity, through skills-based competencies in the local existing, community-based workforce to contribute to basic MSK health and injury care.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Workforce volumes and access continued

6.3 Establish flexible service models, supported by locally appropriate regulation frameworks, to enable the non-medical workforce (e.g. physiotherapists, chiropractors, nurses) to adopt advanced practice/extended scope roles that improve access to evidence-based triage, assessment and management of MSK conditions and injuries.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Workforce training (4 items)

6.4 Increase the number of medical specialist training positions for MSK medicine in low and middle-income countries and integrate MSK health condition management into medical training/curriculum to broaden the knowledge and skills base across medical disciplines.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Workforce training continued

6.5 Build skills-based competencies across medical, nursing and allied health disciplines (and non-clinical roles in low and middle-income countries) in primary care/community settings in the identification/screening of MSK health problems (including identification of 'red flags') and best practice basic management of MSK health conditions and injuries.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Workforce training continued

6.6 Extend training curricula for pre-licensure medical, nursing and allied health clinicians in MSK health, persistent pain and injury care within a biopsychosocial model that emphasises interdisciplinary care.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

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6.7 There is a need for educating and supporting the health workforce to deliver information and care aligned to positive health behaviours in order to reduce modifiable risk factors for MSK health conditions and other non-communicable diseases.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Remuneration

6.8 Increase remuneration for the health workforce in low and middle-income countries to maintain workforce volumes.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Category 7: Surveillance

7.1 National level surveillance capacity is needed to monitor incidence, prevalence and impact of MSK conditions, MSK pain and injuries over time.

Surveillance capacity also needs to be integrated with existing infrastructure and systems.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

7.2 National health surveillance metrics need to include measurement of function, participation, quality of life and care availability and accessibility.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

7.3 National health surveillance capability should include capacity for disaggregation of data by narrow age bands, geography, socioeconomic status and International Classification of Disease (ICD) classification.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Category 8: Research and Innovation

Priority fields of research (5 items)

8.1 Further evidence from epidemiologic and population health research is needed to:

i) demonstrate the risk of developing MSK health conditions across the lifecourse

ii) develop risk assessment tools for MSK conditions

iii) establish common core outcomes for internationally comparable population health research.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Priority fields of research continued

8.2 Further evidence is needed from public health research that examines:

i) health behaviour change in response to public health interventions

ii) how MSK health impairments or injuries impact on health outcomes for other non-communicable diseases

iii) prevention-focused research using dynamic systems modelling to inform policy decisions

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Priority fields of research continued

8.3 Health policy and systems research is needed to evaluate:

i) implementation of MSK health service models across different settings, economies and for different user groups (e.g. older people and younger people)

ii) how systems can reduce inequalities in health and inequities in access to MSK healthcare

iii) the development and utility of classification systems for MSK conditions for use by health systems

iv) the effectiveness and acceptability of digital technologies in improving access to care and surveillance of health behaviours.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Priority fields of research continued

8.4 Clinical and basic science research is needed to:

i) explore curative therapies for MSK conditions

ii) explore new biomarkers, assays and diagnostic applications

iii) extend the evidence base for non-surgical interventions for various MSK health conditions.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Priority fields of research continued

8.5 Health economics research is needed in relation to the following:

i) evidence of the cost of MSK health conditions and injuries to communities and governments

ii) the cost effectiveness of treatments for MSK health

iii) the cost effectiveness of integrating MSK health prevention and management within broader non-communicable disease care

iv) the return on MSK health investment for other sectors such as workforce participation.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Capacity building in MSK research (2 items)

8.6 There is a need to increase capacity in MSK health research globally through supporting:

i) national-level MSK health research

ii) multi-national and interdisciplinary research collaborations

iii) lower-resourced settings undertaking critical local research and participating in international research.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Supplementary file 9

Capacity building in MSK research continued

8.7 More deliberate co-design of research by people with lived experience of various MSK health conditions is needed, as well as ensuring research includes vulnerable populations or minority groups.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Research funding

8.8 An increase in the proportion of research funding for MSK research and additional funding leveraged through public-private partnerships is needed for primary research and to support evidence dissemination and translation.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Innovation and evidence translation (2 items)

8.9 International co-operation and dissemination strategies are needed to facilitate innovation sharing between countries and between researchers and clinicians.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

8.10 Research and innovation that harnesses the emerging potential of digital technologies and the collection and use of 'big data' and machine learning are important for exploring prevention opportunities for MSK health conditions and MSK pain.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Overall perception

Thinking about the components presented, to what extent do you support the overall framework?

- ○ Strongly support
- ○ Support
- ○ Neutral
- ○ Object
- ○ Strongly object

Optional comments

Please use the free-text box below to make any comments about the overall framework of components or a specific component.

When commenting on a specific item please use the item code reference from the Guidebook (e.g. 4.1).

[maximum 500 characters].

National policies concerning musculoskeletal health

Supplementary file 9

Are there any national health policies, strategies, action plans or models of care relevant to musculoskeletal health, musculoskeletal pain or musculoskeletal injury in your country of residence or country of birth that should be reflected in this framework? Policies may be specific to musculoskeletal health or have a component that includes musculoskeletal health.

Please provide the policy name and/or URL below

Do you consent to being named as a contributor in the final project report(s)?

- ○ Yes
- ○ No

For the purposes of the Acknowledgements section, please complete the following details (these details will not be stored with your responses):

Title (i.e. Mr, Ms, Dr, Professor)	
First Name	
Surname	

Block 2

Unfortunately, you do not meet the eligibility criteria to participate in this project at this time. Thank you for your interest in this research.

Please click on the next button to exit the survey.

Block 2

Thank you for taking the time to complete Delphi phase 1.

Please press the SUBMIT button below to send your responses.

Supplementary file 9

SUPPLEMENTARY FILE 10

Delphi Survey Round 2

Curtin University

GLOBAL ALLIANCE FOR MUSCULOSKELETAL HEALTH

Default Question Block

Empirical development of prioritised components for a global strategy for improving musculoskeletal health

Thank you for your participation in Round 1 of the Delphi for this project.Round 2 of

the Delphi is now open until 4th January 2021.

Round 2 is only open to individuals and organisations who participated in Round 1.
The Round 2 survey should not be completed by anyone who did not participate in Round 1.The purpose of

Round 2 is:

- **To present back to you any Delphi items from Round 1 where a consensus was not achieved.**
- **To identify which Delphi items are "essential" and which are "desirable" for a global strategy toimprove prevention and management of musculoskeletal (MSK) health.**
- **To seek your general impression of the revised framework.**
- **To define if and how you would like your name to appear as a contributor on the final report.**

The time commitment to complete this survey is approximately 15 minutes.

Participation in Delphi Round 1

Please confirm that you participated in some or all of the Round 1 survey:

○ I did participate in Round 1.

○ I did not participate in Round 1.

Email address

Please enter your email address (for linking with your previous data). Please use the email address to which the Round 2 invitation was sent

Email:

Round 1 outcomes

In Round 1, you were presented with a *framework of items (components)* for a global strategy for musculoskeletal health. It consisted of 54 items, organised across 8 pillars, including:

y file 9

A total of 674 people (individuals and organisations) rated the importance of one or more of the 54 items ona scale of 1 to 9.

Re-scoring one Delphi item - importance rating

All but one item reached the minimum level of consensus required to be retained in the framework.

You are now requested to re-score item 1.1d. To help with interpretation, you may wish to refer to theupdated Delphi guidebook.

Please assign your perceived level of importance for the item below using a scale from 1 (not at all important) to 9 (extremely important). A 'don't know' option is also available. The Delphi panel medianscores are provided for consideration when re-scoring this item:

Pooled panel median (interquartile range): 7 (2)
Panel high-income countries median (interquartile range): 7 (2)
Panel low and middle income countries median (interquartile range): 8 (3)

Item 1.1d

The built environment sector (urban planners and developers of residential and commercial buildings,open space planners, transport and road safety systems) is a priority sector for engagement and establishment of partnerships to drive increased awareness and advocacy for musculoskeletal health prevention and management.

1 (not at all important)	2	3	4	5	6	7	8	9 (extremely important)	Don't know
○	○	○	○	○	○	○	○	○	○

Defining which items are essential

This next section asks you to consider whether an item is "*essential*" or "*desirable*" for a global frameworkto guide improvements in prevention and management of musculoskeletal (MSK) health. Items are presented across each of the 8 pillars.

Please note: MSK health refers to MSK conditions, MSK pain and MSK injury/trauma.

Based on free-text responses received from Round 1 and to reduce the time burden for Delphi Panellists,the Delphi items have been shortened and simplified.

The Delphi Guidebook also provided in Round 1, has been revised based on comments received and nowshows:

- **The simplified items being presented in Round 2.**
- **The original items presented in Round 1 with any tracked revisions.**
-

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Supplementary file 9

Pillar 1: Engaging, empowering and educating citizens, communities, organisations and governments to act on MSK health

Item 1.1
Improving prevention and management of MSK health requires engagement and partnerships with:

	Essential	Desirable	Unsure
a. Citizens, patients and civil society organisations	○	○	○
b. Industry, workplaces and employers	○	○	○
c. Third party payers/insurers	○	○	○
d. Build environment sector	○	○	○
e. Schools and education facilities	○	○	○
f. National and sub-national governments	○	○	○

Pillar 1: Engaging, empowering and educating citizens, communities, organisations and governments to acton MSK health

	Essential	Desirable	Unsure
Item 1.2 **Improving prevention and management of MSK health requires public education acrossthe following sectors: schools and higher education facilities; workplaces; health professionals; and the community.**	○	○	○
Item 1.3 **Improving prevention and management of MSK health requires globally-relevant educational messages contextualised to local settings.**	○	○	○
Item 1.4 **Use mechanisms to drive public education, including: empowering people with livedexperience to share stories and co-design messages; mass and social media; peer support models and engaging civil society and professional organisations.**	○	○	○

Pillar 2: Leadership, governance and shared accountability

	Essential	Desirable	Unsure
Item 2.1 **MSK health should be explicitly integrated with broader reform efforts for non-communicable diseases (NCDs).**	○	○	○
Item 2.2 **Universal Health Coverage (UHC) essential care packages and/or insurance schemesshould include prevention and management of MSK health impairment.**	○	○	○
Item 2.3 **Strategic global responses for MSK health should explicitly link with and support implementation of existing global and national health system strengthening efforts.**	○	○	○
Item 2.4 ***Global leadership* from the World Health Organization (WHO) in prioritising MSK health isessential to drive a global response to the burden of MSK health impairment.**	○	○	○
Item 2.5 ***Country-level* leadership is needed to prioritise MSK health impairment by national governments.**	○	○	○
Item 2.6 Leadership is needed from ***professional and civil societies*** and citizens that extendsbeyond just MSK health.	○	○	○
Item 2.7 Global and national ***multi-sectoral and inter-ministerial leadership*** is needed toprioritise action on policy and financing for MSK health.	○	○	○
Item 2.8 **Global and national health and performance indicators must extend beyond mortalityreduction to consider function and participation.**	○	○	○
Item 2.9 **A meaningful, acceptable and internationally comparable classification system is**	○	○	○

Supplementary file 9

	Essential	Desirable	Unsure
Item 2.10 Legislation and regulation are needed to sustain reform efforts in health systemstrengthening for non-communicable diseases, including MSK	○	○	○

Pillar 3: Financing

	Essential	Desirable	Unsure
Item 3.1 Existing healthcare financing models need to integrate health promotion and health caredelivery for MSK health.	○	○	○
Item 3.2 Financing models for MSK health should accommodate flexibility for public-private partnerships, partnerships with civil society, international aid, tagged donorships andrevenue-raising strategies.	○	○	○
Item 3.3 Support multi-national foreign aid for MSK care in low resource settings.	○	○	○
Item 3.4 Allocated funding, essential medicines funding and donor funding for MSK health andinjury care need to be quarantined.	○	○	○
Item 3.5 Financing for MSK healthcare should cover well defined, high-value (effective, safe, affordable) packages of care for prevention, diagnosis, and management, particularly forcommunity-based interventions.	○	○	○
Item 3.6 Financing models should incentivise prevention and integrated inter-disciplinary care forMSK health conditions.	○	○	○

Pillar 4: Service delivery

	Essential	Desirable	Unsure
Item 4.1 Service models for MSK conditions need to support early diagnosis and triage and management through local care pathways.	○	○	○
Item 4.2 Local care pathways should support essential packages of affordable, effective and safe care for MSK health impairment, while de-adopting care that is not supported by evidence,is costly and potentially harmful.	○	○	○
Item 4.3 Services for MSK healthcare should be integrated with service models for non-communicable diseases (NCDs) and services that target the broader social determinantsof health.	○	○	○
Item 4.4 Evidence-based diagnostic and therapeutic practices should be prioritised in service models over approaches that are not supported by evidence, are costly and potentiallyharmful.	○	○	○

	Essential	Desirable	Unsure
Item 4.5 Service models for MSK conditions should support integrated, person-centred care thattargets functional ability through a biopsychosocial approach.	○	○	○
Item 4.6 Service models for MSK healthcare should promote community-based interdisciplinarycare.	○	○	○
Item 4.7 MSK care should be integrated into existing community- or regionally-based servicemodels for non-communicable disease care.	○	○	○
Item 4.8 Community-led service models for MSK healthcare should be co-designed by the community.	○	○	○

	Essential	Desirable	Unsure
Item 4.9 Service models should prioritise access to health information and care to vulnerablegroups.	○	○	○

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	Essential	Desirable	Unsure
Item 4.10 Primary and secondary prevention initiatives for non-communicable diseases shouldinclude MSK health.	○	○	○
Item 4.11 MSK-specific primary prevention initiatives should be delivered where evidence of clinicaland cost effectiveness exists.	○	○	○
Item 4.12 National injury (sport, workplace, falls) and trauma prevention strategies and campaignsare needed.	○	○	○

Pillar 5: Equitable access to medicines and technologies

	Essential	Desirable	Unsure
Item 5.1 Countries need to identify, resource and provide access to essential therapeutics forpriority MSK conditions.	○	○	○
Item 5.2 Global and national prioritisation and management is needed in innovation and access tolow cost assistive devices, technologies and interventions that support	○	○	○

Pillar 6: Workforce: building workforce capacity, systems and tools

	Essential	Desirable	Unsure
Item 6.1 Increase the number of medical specialists and allied health practitioners for MSK healthcare in low and middle-income settings.	○	○	○
Item 6.2 Build capacity in the local existing community-based workforce to contribute to basic MSKhealth and injury care.	○	○	○
Item 6.3 Establish flexible service models to enable the non-medical workforce (e.g. nurses, pharmacists, allied health practitioners) to adopt advanced practice/extended scope rolesthat improve access to evidence-based triage, assessment and management of MSK conditions and injuries.	○	○	○
Item 6.4 Integrate MSK health into curricula across medical disciplines and increase the number ofMSK medical specialist training positions in low and middle-income countries.	○	○	○

	Essential	Desirable	Unsure
Item 6.5 Build skills-based competencies across medical, nursing and allied health disciplines (andnon-clinical roles in low and middle-income countries) in the identification of MSK health problems and basic prevention and management practices.	○	○	○
Item 6.6 Extend training curricula for pre-licensure medical, nursing, pharmacy and allied healthclinicians in MSK health, persistent pain and injury care with a biopsychosocial model.	○	○	○
Item 6.7 Educate healthcare workers and health planners to deliver information and care aligned topositive health behaviours for MSK health and other non-communicable diseases	○	○	○

Pillar 7: Surveillance - monitoring population health

	Essential	Desirable	Unsure
Item 7.1 Build country-level population health surveillance capacity to monitor incidence, prevalence and impact of MSK conditions.	○	○	○
Item 7.2 National health surveillance metrics need to include measurement of function, participation, quality of life and care experience.	○	○	○

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	Essential	Desirable	Unsure
Item 7.3 **Surveillance outcomes should be disaggregated by age, sex and gender, geography,socioeconomic status and by the International Classification of Disease (ICD) and International Classification of Functioning, Disability and**	○	○	○

Pillar 8: Research and Innovation

	Essential	Desirable	Unsure
Item 8.1 **Priority research field 1 - Epidemiologic and population health research**: lifecourserisk factors; risk assessment tools; core outcomes for population health research.	○	○	○
Item 8.2 **Priority research field 2 - Public health research**: public health interventions to shift health behaviours; impact of MSK health on other conditions; dynamic systems modellingto inform public health policy.	○	○	○
Item 8.3 **Priority research field 3 - Health policy and systems research**: implementation of MSKservice models across contexts; strategies to reduce health inequities; development of MSK health classification system; effectiveness and acceptability of digital technologies to support MSK care and surveillance.	○	○	○
Item 8.4 **Priority research field 4 - Clinical and basic science research**: mechanisms associatedwith MSK conditions, including persistent pain; curative therapies for MSK conditions; biomarkers, assays and diagnostic applications; extend evidence for non-surgical and **non-pharmacologic interventions.**	○	○	○
Item 8.5 **Priority research field 5 - Health economics: cost of MSK health conditions and injuriesto communities and governments; cost effectiveness of treatments; cost effectiveness of integrating MSK health prevention and management within broader non-communicable disease care; and return on MSK health investment for other sectors such as workforce participation.**	○	○	○

	Essential	Desirable	Unsure
Item 8.6 **Capacity priority 1: support national-level MSK health research; multi-national and interdisciplinary research collaborations; and lower-resourced settings undertaking criticallocal research.**	○	○	○
Item 8.7 **Capacity priority 2: Support co-design of research by people with lived experience ofvarious MSK health conditions and clinicians.**	○	○	○
Item 8.8 **Increase the proportion of research funding allocated to MSK research and allocate additional funding leveraged through public-private partnerships.**	○	○	○
Item 8.9 **Support innovation sharing between countries and between researchers and clinicians.**	○	○	○
Item 8.10 **Support research that harnesses the emerging potential of digital technologies and**	○	○	○

Perspectives on the overall framework of components for a musculoskeletal health strategy

Please indicate your level of agreement to the statements below about the overall framework ofcomponents for a global strategy for MSK health.

The framework of components is:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. valuable to inform a global strategic response to improvingmusculoskeletal health.	○	○	○	○	○
2. credible to inform a global strategic response to improvingmusculoskeletal health.	○	○	○	○	○

Supplementary file 10

Acknowledgement of participation in final report

	Yes	No
Do you consent to being named as a contributor in the Acknowledgements section of the final project report(s)?	○	○
Do you wish to receive a copy of the final report?	○	○

For the purposes of the Acknowledgements section, please indicate your name

Title (e.g. Mr, Ms, Dr,	
Professor)First name	
Surname	

Block 2

Thank you for your interest in this work.
Since you did not participate in the Round 1 survey, you are ineligible to respond to this survey.

Please click on the NEXT button to exit the survey.

Block 2

Please press the SUBMIT button below for your response to be recorded.

Thank you for your participation.

SUPPLEMENTARY FILE 11

Supplementary file 11

Empirical development of prioritised components for a global strategy for improving musculoskeletal health

Global eDelphi guidebook

December 2020

Supplementary file 11

About this project

Muscle, bone and joint (musculoskeletal) conditions, pain and injuries are the leading cause of disability globally and relevant across the lifecourse. Persistent and recurrent pain, reduced physical function and impaired quality of life are unifying features of musculoskeletal health impairments. Despite the significant personal and community burden associated with musculoskeletal conditions, musculoskeletal pain and musculoskeletal injury/trauma, global guidance and national health policy responses to address musculoskeletal health and associated persistent pain, reduced physical function and quality of life are lacking.

This project aims to engage and consult with the global musculoskeletal health community and other important multi-sectoral stakeholder groups to co-design components of a global strategy for musculoskeletal health.

For this project, 'musculoskeletal health' includes musculoskeletal (MSK) conditions, MSK pain (e.g. back or neck pain) and MSK injury and trauma. Musculoskeletal conditions include conditions that affect the muscles, bones or joints (e.g. arthritis, gout, osteoporosis, sarcopenia, auto-immune conditions).

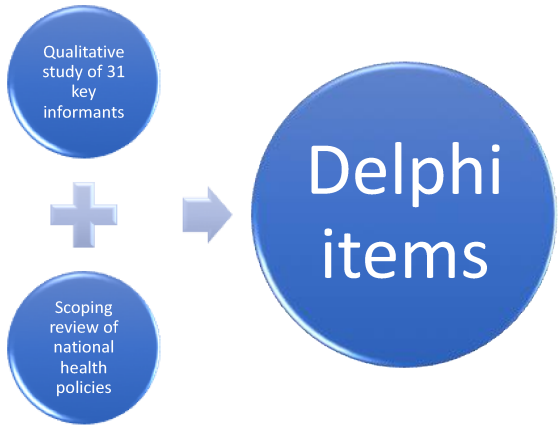
The purpose of this project is not to develop a full strategy, but rather, *to identify important components to guide later strategy development*. The work aims to create a locally-adaptable blueprint for a global strategy to support country-level health system strengthening in value-based musculoskeletal health, injury and pain care that is co-designed and supported by the global community, including patients.

An international project team is undertaking this work in partnership with the Global Alliance for Musculoskeletal Health (G-MUSC). The project is funded by the Bone and Joint Decade Foundation.

Current stage of the project

The current stage of the project is a global eDelphi. The items within the Delphi are data-driven. Specifically, they have been derived from two earlier streams of work, including

i) interviews with 31 key informants from across the globe (including patients and advocacy organisations) and;
ii) ii) a scoping review of national health policies relevant to musculoskeletal health (Figure).



The first Delphi round (Round 1) was conducted between 2 October and 3 November 2020. Responses from 798 individuals were recorded, of which 674 (84.5%) provided a response

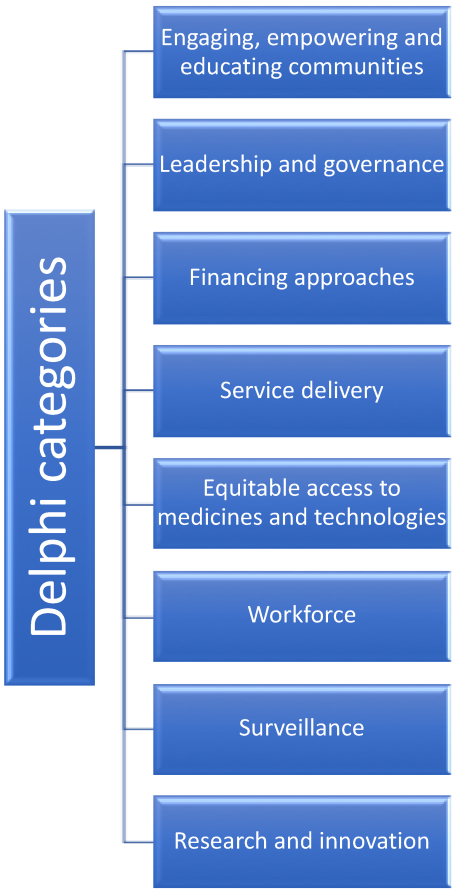
to one or more Delphi items. In addition to analysis of quantitative outcomes, free-text responses were also analysed and considered in revising the Delphi items for Round 2.

About this Guidebook

In **Round 1**, the Guidebook was intended to assist Delphi Panellists answer questions about the importance of each Delphi item by providing additional detail around the scope and intent of each item. In **Round 2**, the Guidebook demonstrates how the Delphi items have been revised, based on free-text feedback submitted by respondents in Round 1. The Guidebook is copyright and may not be reproduced in whole or in part. The next section explains how to use the Guidebook.

How to use this guidebook

- The Delphi survey is structured around eight categories (Figure). Each category contains a number of items, **derived from interviews with key informants and a review of national health policies**.
- Importantly, the eight categories are supported by five guiding principles and seven enablers, which are not presented in the Delphi survey, but for context, are provided in the Table on the following page.
- Each Delphi item is framed around specific actions or priorities relevant to each of the eight categories.
- In **Round 1**, each item was written as a brief statement, summarising rich information collected from the earlier phases of the project (interviews and policy review). In **Round 2**, each item has been further compressed to simplify concepts and shorten the Round 2 survey. To assist with interpretation of the items, this Guidebook provides further detail that underpins each item in the form of a more detailed commentary.



In Round 2, the Guidebook can be used to:
1. help with understanding the scope of item 1.1d; and
2. identify how other items have been revised, based on free-text feedback received from respondents in Round 1.

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Table 1. Summary of guiding principles and enablers.

Guiding principles	**Enablers**
1. Reduce the global disability burden associated with musculoskeletal health conditions, musculoskeletal pain and injury. 2. Adopt a lifecourse and preventive approach. 3. Equity and value-based: equitable and early access to the right care.^ 4. Adaptability: guidance is intentionally adaptable to local context. 5. Inclusiveness: co-design through broad consultation across economies and with patients.	1. Increase societal and government awareness of musculoskeletal health and the impacts of musculoskeletal-related disability. 2. Identify essential, evidence-based standards or actions to enable lower-resourced settings to initiate reforms. 3. Align with existing global or regional strategies or polices. 4. Provide guidance on musculoskeletal health in the context of pandemics; e.g. COVID-19. 5. Translate guidance into multiple languages. 6. Leverage multi-sectoral partnerships and co-operation. 7. Co-design objectives and performance indicators.

^ *right care* refers to care that is effective, safe and cost effective relative to alternatives.

Supplementary file 11

Category 1: Engaging, empowering and educating citizens, communities, organisations and governments to act on MSK health

Item	Compressed Delphi item (Round 2)	Delphi item (Round 1)	Extended commentary
Priority sectors for pursuing engagement and forging partnerships to support prevention and management of MSK health			
1.1	Improving prevention and management of MSK health requires **engagement and partnerships** with: **1.1a** Citizens, patients and civil society organisations **1.1b** Industry, workplaces and employers **1.1c** Third-party payers/insurers **1.1d** Built environment sector **1.1e** Schools and education facilities	Priority sectors for engagement and establishment of partnerships to drive increased awareness and advocacy for MSK health prevention and management include: citizens, patients and civil society organisations; industry, employers and workplaces; insurers; the built environment sector (urban planners and developers of residential and commercial buildings, open space planners, transport and road safety systems); schools and higher education facilities; and national and sub-national governments.	**1.1a Citizens, patients and civil society organisations**: Engaging and empowering citizens and patients to learn more about MSK health and act on prevention and management, such as through awareness campaigns, will be essential to achieving population health gains and reducing disability. Forging partnerships between governments and civil society/community organisations can be an effective mechanism to drive citizen and patient engagement, in particular for engaging with vulnerable groups; e.g. older adults and minority groups. **1.1b Industry, workplaces and employers**: Engaging with and supporting industry, workplaces and employers to act on injury prevention and management, support return to work after injury and implement workplace accommodations to enable people with compromised functional ability due to MSK health conditions to equitably participate in work will be important for maintaining national work productivity and financial security of individuals. **1.1c Third-party payers/insurers**: Engaging with health and industry insurers to prioritise MSK health in insurance schemes will be important to facilitate access to care and prevention and management of work-related injury. **1.1d Built environment sector (urban planners and developers of residential and commercial buildings, open space planners, transport and road safety systems)**: Engagement and partnership with the built environment sector is needed to improve access to infrastructure; mobility, function and participation within built environments; and safety for people with MSK health conditions (e.g. being able to safely cross roads and exit residential or commercial buildings). In addition, there is a need to more optimally design urban open spaces to enable and encourage citizens to make positive health behaviour choices, such as the ability to safely play, recreate and engage in physical activity locally.

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	1.1f National and sub-national governments.		**1.1e Schools and education facilities:** Engagement and partnership with schools and education facilities is needed to support education about prevention and management of MSK health conditions and design environments and curriculum that support healthy behaviours for children, in particular, support for participation in physical activity and healthy eating. **1.1f National and sub-national governments**: there is a need for whole-of-community engagement with national and sub-national governments to define MSK health and advocate for action on MSK heath given the enormous burden of disease and costs associated with MSK conditions and injury and trauma. Advocacy around threats to economic development and sustainability and return on investment is important in the context healthcare expenditure, work productivity loss and absenteeism, taxation revenue loss, social care payments and socioeconomic consequences for families and communities.
Priority sectors for public education			
1.2	Improving prevention and management of MSK health requires **public education** across the following sectors: schools and higher education facilities; workplaces; health professionals; and the community.	MSK education should be disseminated to the following sectors: schools and higher education facilities; workplaces and employers; health professionals; and the community at large and championed by community and religious leaders. Education that should cover domains that include: the importance of MSK health to human function and participation across the lifecourse, how to maintain MSK health and prevent MSK injury, a contemporary understanding of pain and the impacts of impaired MSK health.	**Priority sectors for public education** • In schools and higher education facilities prioritise education about MSK health and its importance across the lifecourse and a contemporary understanding of pain. • Educate industry and workplace insurance providers how workplaces can prevent MSK injury (e.g. through risk identification and mitigation), support healthy work habits (e.g. through promotion of movement and activity) and support people with MSK health impairments to maintain productivity and return to work. In this regard, workplaces can be used as an effective portal and model for public health education. • Support the dissemination of best-practice evidence for prevention and management of MSK health and injury to educate the health workforce at scale. • Society and community at large (including government and policy makers), including tailored messages and approaches for vulnerable groups (e.g. those of lower socioeconomic status, people with intellectual and/or developmental disabilities, people in rural settings, ethnic minority groups):

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			○ Educate society/community at large concerning the importance of MSK health for living well (i.e. functional ability and socioeconomic security and welfare across the lifecourse), so that the value of MSK health is better understood and misperceptions are corrected. ○ Educate society/community at large concerning exposure to modifiable risk factors for MSK health loss, including physical inactivity, obesity, malnutrition, smoking and how to adopt and maintain positive health behaviours to achieve better MSK health and quality of life. Education needs to also focus on early detection and intervention for both disease features and unhelpful behaviours. This is particularly relevant in resource-limited settings. ○ Educate the society/community at large to address misconceptions about management of MSK health conditions and MSK pain. Specifically, provide education about what is the right care for MSK health conditions and MSK pain, the role of early detection and treatment and a contemporary understanding of pain.
Priority messages for public health education about MSK health			
1.3	Improving prevention and management of MSK health requires globally-relevant **educational messages** contextualised to local settings.	Disseminate consistent, high-priority public health messages for MSK health prevention and management that are globally relevant and can be appropriately contextualised to local settings.	**High priority messages include**: • MSK health enables function, participation and enjoyment across the lifecourse, with the impacts of impaired MSK and persistent pain profound and wide reaching, including increased risk of mortality. This message should be supported by concrete examples and metrics that are locally relevant and understandable by the general population. • Physical activity, play, sport and movement are essential for good MSK health, mobility, function and preventing multiple diseases. • MSK conditions and MSK pain are relevant across the lifecourse - they are not an inevitable part of ageing and they impact young people too. • There are effective strategies to manage many MSK health conditions and MSK pain to improve function and quality of life. Interventions are most effective when they are introduced early and coupled with positive lifestyle and behavioural changes. On the other hand, there are also many interventions that are less effective and potentially harmful (low-value), particularly for long-term MSK pain where the experience of pain may not be related to musculoskeletal structures.

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			• MSK health conditions are the most significant global healthcare problem in terms of disability (activity impairment and work loss) and cost to individuals and communities. • MSK health is not just about diseases. The majority of trauma, sporting injuries and workplace injuries are musculoskeletal in nature. • Many MSK health conditions and injuries can be prevented by raising awareness about modifiable risk factors and screening for some MSK conditions.
Priority enablers to drive advocacy and support community-wide education			
1.4	Use mechanisms to drive public education, including: empowering people with lived experience to share stories and co-design messages; mass and social media; peer support models and engaging civil society and professional organisations.	Use globally-relevant mechanisms to drive advocacy and deliver community-wide education about MSK health through: empowering people with lived experience to share stories and co-design messages; using mass and social media; adopting peer support models and supporting civil society and professional organisations.	**Priority enablers to drive advocacy and support community-wide education**: • Empower people with lived experience, including children and their families, from different settings and with different conditions and injuries to share stories relevant to local and cultural contexts and co-design messages. Importantly, lived experiences should also reflect vulnerable and minority groups. • Leverage mass media and social media to disseminate education and advocacy messages. • Peer support models and group-based education, relevant to the local context, to support people with long-term MSK health conditions. • Support and resource civil society, such as national or sub-national advocacy organisations, to champion advocacy and education initiatives and empower and support patients, governments and society with accurate knowledge about MSK health conditions, their prevention and management, and strategies for system reform. • Empower and support professional clinical associations to assume advocacy roles and foster relationships with their national government.

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Category 2: Leadership, governance and shared accountability

Item	Compressed Delphi item (Round 2)	Delphi item (Round 1)	Extended commentary
Integration with existing policy and system strengthening reforms			
2.1	MSK health should be explicitly integrated with broader reform efforts for non-communicable diseases (NCDs).	MSK health conditions and MSK pain need to be more explicitly integrated with broader non-communicable disease (NCD) reform efforts in policy, resourcing and service planning by national governments. This is to ensure: i) they are recognised as critical NCDs; and ii) to harness the shared risk factors and management strategies between MSK health conditions and other NCDs.	MSK health conditions and MSK pain are not adequately integrated with non-communicable disease (NCD) prevention and management policy and financing in a manner commensurate with their established burden of disease. The focus on mortality reduction in NCD reform deprioritizes the disability burden associated with MSK conditions and persistent pain. There is an urgent need to more explicitly integrate MSK health conditions and pain with broader NCD reform efforts by national governments, with guidance and leadership from the World Health Organization (WHO). Given the shared risk factors and shared management strategies between many NCDs and MSK health conditions (e.g. smoking, alcohol use, nutrition, obesity, physical activity), integration and strategy alignment would serve to positively impact not only MSK health conditions, but also other NCDs. This is further reinforced by the fact that prevalent MSK conditions are a risk factor for developing other NCDs.
2.2	Universal Health Coverage (UHC) essential care packages and/or insurance schemes should include prevention and management of MSK health impairment.	Policy and resourcing decisions for Universal Health Coverage (UHC) essential care packages and/or insurance schemes should include prevention and management of MSK health conditions, pain and injury due to the associated disability burden, especially in the context of co-morbidity with other NCDs.	Healthcare (prevention and management) for MSK conditions, pain and injury should be guaranteed in all countries through Universal Health Coverage (UHC). This is warranted due to the disability burden imposed by these conditions and the prevalence of MSK health conditions in co- and multi-morbid NCD health states where it is usually the MSK condition(s) that is the main contributor to disability. In countries with health coverage through established public, private, social or statutory insurance schemes, coverage for MSK health should be included.
2.3	Strategic global responses for MSK health should explicitly link with and support implementation of	A global strategy for MSK healthcare, pain and injury should explicitly link with and support implementation of existing global and national efforts in health system strengthening, for	A global strategy for MSK healthcare, pain and injury should explicitly link with and support implementation of existing global and national efforts in health system strengthening, for example in care integration (e.g. *WHO Framework on integrated people-centred health services*), ageing (e.g. *WHO Global strategy and action plan on ageing and health*), rehabilitation (e.g. *WHO Rehabilitation 2030* agenda), disability (e.g. *WHO Global disability*

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	existing global and national health system strengthening efforts.	example in care integration, ageing, rehabilitation, NCD care, and injury and trauma prevention and management.	*action plan 2014-2021*) NCD care (e.g. *WHO Global action plan for the prevention and control of noncommunicable diseases 2013-2020*), injury prevention and trauma care.
Global and national leadership to prioritise MSK health, pain and injury prevention and care			
2.4	***Global leadership*** from the World Health Organization (WHO) in prioritising MSK health is essential to drive a global response to the burden of MSK health impairment.	*Global* leadership from the World Health Organization (WHO) in prioritising MSK health is essential to catalyse a global response to the burden of MSK disease, particularly in low and middle-income countries and to inform strategic activities of global clinical organisations. Leadership would take the form of the development of a Strategy, Action Plan or Guideline.	Global leadership from the World Health Organization (WHO) in prioritisation of MSK conditions, pain and injury is essential to catalyse a global response to the burden of disease, particularly in low and middle-income countries (LMICs) and to inform the strategic activities of global clinical organisations. In this regard, there is a need for a global Strategy, Action Plan or Guideline to help Member States initiate appropriate policy, financing and health service reform initiatives and for clinical organisations to prioritise their efforts in global reform and advocacy initiatives.
2.5	***Country-level*** leadership is needed to prioritise MSK health impairment by national governments.	*National* leadership through MSK champions is needed in each country to advocate for higher prioritisation of MSK health by governments and for governments to work collectively to advocate for the World Health Organization (WHO) to act on MSK health globally. In order for national governments to respond to MSK health, there is a need to inform them about the human capital and economic benefits (e.g. return on investment) of acting on MSK-related disability prevention and management.	National leadership is required to advocate for prioritisation and action on prevention and management of MSK health and injury by governments, commensurate with their established burden of disease across the lifecourse. To increase prioritisation of MSK health by government there is a need to communicate the disease burden to all governments, relative to other health states where larger proportions of health resources are currently directed by MSK champions. National governments need reliable evidence on the local burden of disease and cost data in order to catalyse leadership for local system reform and to work collectively with other governments to advocate to the World Health Organization (WHO) to act on MSK health. In particular, national leadership in advocacy and policy formulation that emphasises the importance of MSK-related disability prevention on human capital and economic development (e.g. return on investment) is needed. Leadership activity should extend beyond advocacy to include the establishment of local systems to facilitate decision-making; e.g. responding to new evidence. Structurally, this may include establishment of appropriately regulated expert advisory groups/taskforces, or stakeholder committees within and/or across the health system in partnership with civil society partner organisations.

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2.6	Leadership is needed from ***professional and civil societies*** and citizens that extends beyond just MSK health.	Leadership from professional and civil societies and citizens that extends beyond just MSK health, pain and injury care is needed.	Collaborative engagement and consultation between professional/clinical and civil society organisations and citizens across the health sector (i.e. beyond just MSK health and injury groups), with national governments and the WHO is needed to advocate for the prioritisation of MSK health and injury prevention and management in national health reform efforts.
2.7	Global and national ***multi-sectoral and inter-ministerial leadership*** is needed to prioritise action on policy and financing for MSK health.	Global and national multi-sectoral and inter-ministerial leadership with dedicated responsibility within health ministries for MSK health is needed to prioritise action on policy and financing for MSK health.	Global and national leadership across sectors and government ministries (i.e. beyond the health sector, e.g. social care, industry, sport, transport) is critically important to elevate the priority of MSK health prevention and management to government, industry and private organisations. Multi-sectoral and inter-ministerial leadership in MSK health will facilitate better integration of prevention and management initiatives across public policy and financing, which is essential to achieve impact. At the government level, leadership may include specific Ministerial responsibility for MSK health and the establishment of dedicated focal points in national governments and global organisations for MSK health.
Measurement and classification			
2.8	Global and national health and performance indicators must extend beyond mortality reduction to consider function and participation.	Health indicators and performance measures must extend beyond mortality reduction and consider function and participation (or disability prevention).	Measures of health and performance in health reform must extend beyond mortality reduction and consider function/participation restriction and recognise the health and economic benefits of disability prevention. An expansion in targets and performance measures to recognise function and participation will better support systems strengthening for MSK health.
2.9	A meaningful, acceptable and internationally comparable classification system is needed for MSK health.	A meaningful, acceptable and internationally comparable classification system is needed for MSK health to appropriately plan policy, health services, care pathways, and financing reforms.	Countries need to classify MSK health states into meaningful diagnostic categories rather than symptomatology alone, supported by guidance from WHO and in alignment with the International Classification of Disease (ICD) system, in order to make sense of the wide constellation of MSK conditions. Such classification is needed to design appropriate local models of service delivery, workforce configurations and financing to support care pathways for different classifications of MSK conditions.

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			Without classification, the scale of the problem is too large and too complex to initiate meaningful action, particularly for lower-resourced countries. Classification also enables countries to prioritise responses to specific groups of MSK conditions based on national need.
Legislation and regulation			
2.10	Legislation and regulation are needed to sustain reform efforts in health system strengthening for non-communicable diseases, including MSK health.	Legislation and regulation are needed to sustain reform efforts in health system strengthening for non-communicable diseases, including MSK health, and to mitigate changes in priorities as governments change.	National legislation and regulation to support long-term health system strengthening for non-communicable diseases (NCDs), including MSK health, is needed to sustain efforts with successive changes in governments. This will be particularly important in the wake of COVID-19 as priorities shift to communicable diseases.

Supplementary file 11

Category 3: Financing

Item	Compressed Delphi item (Round 2)	Delphi item (Round 1)	Extended commentary
Integrated financing models			
3.1	Existing healthcare financing models need to integrate health promotion and health care delivery for MSK health.	Existing healthcare financing models need to accommodate health promotion and health care delivery for MSK health. This may be achieved through integrated financing for health promotion, non-communicable disease care, injury and trauma care, or ageing and long-term care.	Existing healthcare financing models need to accommodate health promotion and health care delivery for musculoskeletal (MSK) health conditions, MSK pain and MSK injury in multidisciplinary models. This may be achieved in financing for health promotion, non-communicable disease (NCD) care, injury and trauma, or ageing and long-term care. Integrating funding for MSK health care with other established funding priorities will be important, particularly in the context of COVID-19 where new funding streams will be extremely limited. In the context of global burden of disease data, there is a strong rationale for an increased allocation of funding for MSK health.
Flexibility for different financing models			
3.2	Financing models for MSK health should accommodate flexibility for public-private partnerships, partnerships with civil society, international aid, tagged donorships and revenue-raising strategies.	Financing models for MSK health promotion and care should accommodate the flexibility for public-private partnerships, partnerships with civil society, international aid, tagged donorships and revenue-raising strategies, such as taxes for condition-specific care (e.g. injury and trauma care).	Financing models for MSK health promotion and care should accommodate the flexibility for public-private partnerships, partnerships with civil society, international aid, tagged donorships underpinned by appropriate regulation to avoid unhelp commercial influence and conflicts of interest, and the option for specific revenue-raising through taxes for specific purposes, such as supporting care of the injured through workplace taxes or transport/fuel taxes. Flexibility in funding models is also important to enable health systems to respond to emerging innovations or technological advancements that may improve health outcomes.
3.3	Support multi-national foreign aid for MSK care in low resource settings.	Support multi-national foreign aid for MSK care in low resource settings and where priority for MSK health financing is low.	Multinational foreign aid is needed to support MSK health prevention and care in low resource settings and where basic care for MSK health cannot be sustainably delivered due to competing health priorities and limited resources.

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3.4	Allocated funding, essential medicines funding and donor funding for MSK health and injury care need to be quarantined.	Financing models should enable protection of allocated funding or donor funds for MSK health and injury care as well as quarantined funds for essential medicines.	Governments need a specific budget allocation for prevention and management of MSK conditions and the ability or regulation to quarantine donor funds for MSK health services, particularly to ensure access to essential medicines in lower resourced countries.
Financing for the right care, by the right team, in the right place			
3.5	Financing for MSK healthcare should cover well defined, high-value (effective, safe, affordable) packages of care for prevention, diagnosis, and management, particularly for community-based interventions.	Healthcare financing should be directed towards well defined, high-value (effective, safe, affordable) packages of care for prevention, diagnosis, and management of MSK health conditions and injury within Universal Health Coverage packages and/or other insurance systems, particularly for community-based interventions.	Financing models, particularly for low and middle-income countries (LMICs), should be formulated to support essential packages of care for MSK health conditions and injury, where funding of treatments and prevention strategies should be based on evidence, safety and cost effectiveness, targeting low cost and high yield. Ideally, these funding packages should be part of Universal Health Coverage essential packages and other locally relevant insurance schemes to minimise or remove out-of-pocket expenses. Packages should be tailored to different levels of the health system from community care through to tertiary care. Initial priority packages of funding should be directed towards interdisciplinary community-based care where out of pocket expenses are minimised or removed. For LMICs in particular, efforts to integrate packages of MSK interventions with established packages (e.g. 'Best Buys' for NCDs) should be prioritised to maximise return on investment across conditions.
3.6	Financing models should incentivise prevention and integrated inter-disciplinary care for MSK health conditions.	Financing models should incentivise prevention and integrated inter-disciplinary care for MSK health conditions.	Financing models should incentivise prevention (based on established modifiable risk factors) and integrated, interprofessional care for MSK health conditions so that a continuum of care is supported, as well as care between health settings and service providers.

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Category 4: Service delivery

Item	Compressed Delphi item (Round 2)	Delphi item (Round 1)	Extended commentary
Care at the right time: early diagnosis, triage and intervention for secondary prevention			
4.1	Service models for MSK conditions need to support early diagnosis and triage and management through local care pathways.	Service models for MSK conditions need to support early diagnosis and triage through appropriate assessment and timely initiation of effective treatments aligned to locally-supported care pathways.	Service models need to promote early diagnosis and triage into appropriate, locally-supported care pathways that include referral systems to provide emergency or urgent care (e.g. trauma) or specialist-level care when indicated to arrest chronicity and disability, especially in younger people and those with inflammatory diseases.
Delivery of the right care: effective, safe, affordable and accessible			
4.2	Local care pathways should support essential packages of affordable, effective and safe care for MSK health impairment, while de-adopting care that is not supported by evidence, is costly and potentially harmful.	Formulate local care pathways based on essential packages of affordable, effective and safe care for MSK health conditions, pain and injury while disinvesting in care that is not supported by evidence, is high cost and potentially harmful.	Service models should promote the 'right care', that is effective (evidence-based), safe, affordable and accessible care, through locally-supported care pathways that enable interdisciplinary care and access to tertiary or specialist-level care when needed, particularly in areas of high need/limited access. Care pathways and their components may be derived by defining essential packages of affordable and effective care for established classifications of MSK conditions and injuries, with an emphasis on low cost and high yield interventions, which in many cases will be non-surgical care outside the context of trauma. Low value diagnostic tests and interventions should not be recommended in essential packages for funding and should be defunded. Coupled with the formulation of care pathways and essential care packages is the need for building workforce capacity to provide the right care.
4.3	Services for MSK healthcare should be integrated with service models for non-communicable diseases (NCDs) and services that target	Services for MSK health conditions, pain care and injury care should be integrated with existing service models for non-communicable disease (NCD) care and service initiatives that target the broader social determinants of health. This integration is needed to	Services for MSK health conditions, pain care and injury care should be integrated with existing service models for non-communicable disease (NCD) care and service initiatives that target the broader social determinants of health. In some settings, piloting such integration may be warranted to produce data on satisfaction, cost and health outcomes. In this regard, MSK health should be considered as an important component to holistic, person-centred care healthcare. This is justified on the basis of the high prevalence of MSK health conditions in co-

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	the broader social determinants of health.	reduce the impact of MSK co-morbidities in NCD care, reduce the risk of developing other NCDs and enable participation in active rehabilitation for NCDs.	and multi-morbidity health states for NCDs and the increased risk of developing NCDs on a background of MSK health impairment.
4.4	Evidence-based diagnostic and therapeutic practices should be prioritised in service models over approaches that are not supported by evidence, are costly and potentially harmful.	Best-practice diagnostic investigations and therapeutic interventions should be prioritised in service models over approaches that are not supported by evidence, are high cost and potentially harmful.	The overuse of technology in MSK care in high income countries (e.g. the overuse of musculoskeletal imaging) has been associated with, overall, limited clinical benefit in health outcomes and may promote unhelpful behaviours and beliefs about MSK health and pain care by patients and the broader community. A focus on delivery of safe and effective diagnostic (e.g. imaging) and therapeutic interventions (e.g. safe use of medicines and appropriate indications for surgery) is needed. This may be supported with global and country-level tools such as guidelines and quality standards.
4.5	Service models for MSK conditions should support integrated, person-centred care that targets functional ability through a biopsychosocial approach.	Service models for MSK conditions should support integrated, interdisciplinary person-centred care that targets functional ability and participation through a more contemporary understanding of pain.	Services models that promote integrated, interdisciplinary person-centred care and that target functional ability through a biopsychosocial management approach are needed to shift from a purely disease-focussed and biomedical paradigm.
Delivery of care from the right team: interprofessional service models			
4.6	Service models for MSK healthcare should promote community-based interdisciplinary care.	Service models for MSK healthcare should promote community-based interdisciplinary care, grounded on common standards of MSK care delivery across healthcare providers.	Service models for MSK conditions should promote community-based interdisciplinary care tailored to the needs of the person and grounded in common standards of care delivery across providers. In some settings, primary care may be best triaged and coordinated by trained MSK practitioners or other local providers (e.g. family physicians, paramedical workers, local healers, female health workers) where there are access limitations to specialist medical practitioners. Service models should also enable timely access to tertiary and/or specialist-level care when indicated.

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Delivery of care in the right place: bolstering community and primary care to reduce inequity in access to care			
4.7	MSK care should be integrated into existing community- or regionally-based service models for non-communicable disease care.	MSK care should be integrated into existing community- or regionally-based service models for non-communicable disease care to reduce inequity in access, integrate care across different health conditions and service providers and build capacity in the existing workforce.	Service models for MSK care should be community- or regionally-based and integrated with existing service models for non-communicable diseases and/or traditional care practices to reduce care disparity due to geography and better support integration of care across different health conditions and providers. Depending on workforce availability, community-led models could be primarily responsible for risk assessment, delivery of community-based interventions and on-referral where more advanced care is needed and not available locally.
4.8	Community-led service models for MSK healthcare should be co-designed by the community.	Community-led service models for MSK healthcare should be co-designed by the community to ensure services are aligned with community needs and are appropriate, acceptable, feasible and sustainable.	Community-led service models for MSK healthcare should be co-designed by the community (inclusive of community and religious leaders) to ensure services are aligned with community needs and are appropriate acceptable, feasible and sustainable. Decentralisation of health delivery to municipalities or communities will also better support integration of services with existing community-based initiatives and resources.
4.9	Service models should prioritise access to health information and care to vulnerable groups.	Service models should prioritise access to health information and care to vulnerable groups to mitigate care disparities.	Service models need to prioritise access to health information and care to vulnerable groups (e.g. those of lower socioeconomic status, people with intellectual and/or developmental disabilities, people in rural settings, ethnic minority groups) where care disparities are often wider and health outcomes poorer. For example, telehealth services may be useful in overcoming care disparities due to geography.
Prevention			
4.10	Primary and secondary prevention initiatives for non-communicable diseases should include MSK health	Primary and secondary prevention initiatives for non-communicable diseases should integrate MSK health conditions and pain care, based on common shared risk factors and frequent co-morbidity between conditions.	Primary and secondary prevention initiatives for non-communicable diseases (NCDs) should integrate MSK health conditions and pain care, given the shared risk factors (e.g. smoking, inactivity, obesity, poor nutrition) and frequent co- and multi-morbidity between MSK health conditions and other NCDs.
4.11	MSK-specific primary prevention initiatives should be delivered where evidence of	MSK-specific primary prevention initiatives should be promoted and implemented where evidence of clinical and cost effectiveness exists.	In addition to addressing shared risk factors with other non-communicable diseases, MSK-specific primary prevention initiatives should be included in service models where evidence of clinical and cost effectiveness exists (e.g. osteoporotic fracture prevention).

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	clinical and cost effectiveness exists.		
4.12	National injury (sport, workplace, falls) and trauma prevention strategies and campaigns are needed.	National injury (sport, workplace, falls) and trauma prevention strategies and campaigns are needed to reduce the disability burden associated with MSK-related injury and trauma.	Injury and trauma prevention models are critical for MSK health since most injury and trauma outcomes are MSK-related. Priorities include prevention initiatives for workplace injury, sport injury and trauma from traffic accidents.

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Category 5: Equitable access to medicines and technologies

Item	Compressed Delphi item (Round 2)	Delphi item (Round 1)	Extended commentary
5.1	Countries need to identify, resource and provide access to essential therapeutics for priority MSK conditions.	Countries need to identify and resource essential therapeutics for priority MSK conditions, particularly in the context of pandemics and consider mechanisms to improve access to medicines and effective therapies to reduce inequity in access to care.	There is a need for secure supply chain mechanisms in lower resourced nations to facilitate access to essential therapies for MSK conditions and to enable access to newer, highly effective therapies that control disease activity and improve function. The current COVID-19 pandemic has exposed limitations for MSK healthcare, particularly in low and middle-income countries, including access to care and availability of essential medicines.
5.2	Global and national prioritisation and management is needed in innovation and access to low cost assistive devices, technologies and interventions that support function.	There is a need to prioritise innovation in development of, and access to, low cost assistive devices (living aids) and technologies (e.g. digital technologies, telehealth, joint replacement surgery) to support function, especially in low and middle-income settings.	Research and private partnerships are needed to develop and disseminate low cost assistive devices (living aids) and technologies (e.g. Apps, artificial intelligence, telehealth, surgical innovation such as joint replacement) to improve function and quality of life for people with MSK health conditions or injuries, particularly for use in low resource settings. Coupled with this, there is a need for country-level health technology assessment and management to ensure safety and appropriateness for the local population.

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Category 6: Workforce: building workforce capacity, systems and tools

Item	Compressed Delphi item (Round 2)	Delphi item (Round 1)	Extended commentary
Workforce volumes and access			
6.1	Increase the number of medical specialists and allied health practitioners for MSK healthcare in low and middle-income settings.	Increase the number of medical specialists for MSK healthcare in low and middle-income settings. Depending on local workforce volumes and distributions, increasing workforce volumes for allied health professionals may also be relevant.	In many low and middle-income countries (LMICs) there is very limited access to specialist physicians, surgeons and some allied health professionals, due to workforce volumes being low and distributions being largely in cities or urban centres. The limited volume of health professionals and their training positions in LMICs creates care disparity gaps in access to specialist-level care for MSK health conditions. In coming years, the situation is likely to worsen as ageing and retirement of the current medical specialist workforce will further contribute to volume shortages. In addition to responding to current workforce needs, there is a need to engage in future workforce forecasting to inform appropriate capacity-building strategies.
6.2	Build capacity in the local existing community-based workforce to contribute to basic MSK health and injury care.	Build capacity, through skills-based competencies in the local existing, community-based workforce to contribute to basic MSK health and injury care.	Build workforce capacity in low and middle-income countries to address MSK and injury care by leveraging opportunities and building competencies in the existing local, community-based workforce; including traditional and complementary medicine practitioners, volunteers, community health workers, clinicians and other locally-relevant cadres working in other disease or health areas to deliver MSK information/education and care to patients.
6.3	Establish flexible service models to enable the non-medical workforce (e.g. nurses, pharmacists, allied health practitioners) to adopt advanced practice/extended scope roles that improve access to evidence-based triage, assessment and	Establish flexible service models, supported by locally appropriate regulation frameworks, to enable the non-medical workforce (e.g. nurses, pharmacists, allied health practitioners) to adopt advanced practice/extended scope roles that improve access to evidence-based triage, assessment and management of MSK conditions and injuries.	Establish flexible service models, supported by locally appropriate regulation frameworks, to enable the non-medical workforce (e.g. nurses, pharmacists, allied health practitioners or new workforce cadres such as 'primary musculoskeletal clinicians') to adopt leadership positions through advanced practice/extended scope roles to improve access to evidence-based triage, assessment and management of MSK conditions and injuries, particularly in primary care settings. This strategy may enable more timely access to care and facilitate medical and surgical staff to devote time to where their services are most needed, while building sustainable workforce networks or communities of practice to support training and development.

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	management of MSK conditions and injuries.		
Workforce training			
6.4	Integrate MSK health into curricula across medical disciplines and increase the number of MSK medical specialist training positions in low and middle-income countries.	Increase the number of medical specialist training positions for MSK medicine in low and middle-income countries and integrate MSK health condition management into medical training/curriculum to broaden the knowledge and skills base across medical disciplines.	There is a need to expand opportunities for training of medical specialists in MSK medicine in low and middle-income countries and integrate MSK health conditions management in medical training/curriculum more broadly to build capacity across medical disciplines (e.g. general physicians, primary care/family physicians).
6.5	Build skills-based competencies across medical, nursing and allied health disciplines (and non-clinical roles in low and middle-income countries) in the identification of MSK health problems and basic prevention and management practices.	Build skills-based competencies across medical, nursing and allied health disciplines (and non-clinical roles in low and middle-income countries) in primary care/community settings in the identification/screening of MSK health problems (including identification of 'red flags') and best practice basic prevention and management of MSK health conditions and injuries.	Build skills-based competencies across medical, nursing, pharmacy and allied health disciplines (e.g. through professional development programs) and non-clinical roles in low and middle-income countries in primary care/community settings in the identification/screening of MSK health problems (including identification of 'red flags') and best practice basic management of MSK health conditions and injuries. Such training may require shifting entrenched beliefs and practices about MSK and pain care. Competencies should include early triage and on-referral to more advanced-level care as indicated, supporting effective self-management and delivery of basic, evidence-based education and services (e.g. the advice for managing acute low back pain or other sprains/strains). Workforce competencies could be enhanced through the establishment of clinical networks or virtual communities of practice to support learning in clinical care, cultural competence and health system literacy.
6.6	Extend training curricula for pre-licensure medical, nursing, pharmacy and allied health clinicians in MSK health, persistent pain	Extend training curricula for pre-licensure medical, nursing, pharmacy and allied health clinicians in MSK health (prevention and management), persistent pain and injury care within a biopsychosocial model	Extend training curricula for pre-licensure medical, nursing, pharmacy and allied health clinicians in MSK health, persistent pain and injury care within a biopsychosocial model that emphasises interdisciplinary care. In particular, there is a need for enhanced curriculum for medical students and other health professional students to support delivery of the right, evidence-based care for MSK health and for all disciplines in best-practice care for persistent pain (e.g. aligned with the International Association for the Study of Pain curriculum recommendations).

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	and injury care within a biopsychosocial model.	that emphasises interdisciplinary care.	
6.7	Educate healthcare workers and health planners to deliver information and care aligned to positive health behaviours for MSK health and other non-communicable diseases.	There is a need for educating and supporting healthcare workers and health planners to deliver information and care aligned to positive health behaviours in order to reduce modifiable risk factors for MSK health conditions and other non-communicable diseases.	There is a need for educating and supporting healthcare, public health and health administration/planning workers to deliver information and care aligned to positive health behaviours in order to reduce modifiable risk factors for MSK health conditions and other non-communicable diseases (NCDs). This includes supporting healthily life choices (e.g. nutrition, activity) and health literacy. A greater emphasis from the health workforce on primary and secondary prevention may serve to better support public health initiatives targeting risk reduction for NCDs. In this context, workforce capacity could be enhanced through the establishment of clinical networks or virtual communities of practice.
Remuneration			
6.8	Increase remuneration for the health workforce in low and middle-income countries to maintain workforce volumes.	Increase remuneration for the health workforce in low and middle-income countries to maintain workforce volumes.	There is a need to increase remuneration for health workers who manage people with MSK conditions in low and middle-income countries in order to retain the workforce and attract trainees.

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Category 7: Surveillance: monitoring population health

Item	Compressed Delphi item (Round 2)	Delphi item (Round 1)	Extended commentary
7.1	Build country-level population health surveillance capacity to monitor incidence, prevalence and impact of MSK conditions.	National level surveillance capacity is needed to monitor incidence, prevalence and impact of MSK conditions and MSK pain and injuries over time. Surveillance capacity also needs to be integrated with existing infrastructure and systems.	There is a need to develop national capacity in surveillance of population health states that includes MSK health conditions, pain and injuries. MSK health surveillance should be integrated with existing national health surveillance systems, rather than promoting the establishment of stand-alone monitoring. Integration with existing surveillance systems and metrics is important to ensure a comprehensive understanding of population health and relative burden of disease. In some contexts, integration of data may require data linkage systems. Surveillance capacity requires infrastructure and systems for accurate population health assessments (e.g. population health surveys; occupational injury systems; road traffic injury systems). In particular, there is a need to measure national-level outcomes of incidence, prevalence and system impact (e.g. cost and health service utilisation) over time. Local surveillance data inclusive of prevalence, cost and morbidity are critical to inform appropriate national-level responses to local burden of disease estimates, support local advocacy efforts and contribute to global burden of disease research.
7.2	National health surveillance metrics need to include measurement of function, participation, quality of life and care experience.	National health surveillance metrics need to include measurement of function, participation, quality of life and care availability, accessibility and satisfaction.	Surveillance metrics needs to extend beyond disease and injury measurement (prevalence, incidence) and cost (service utilisation) to also monitor disease impacts (function, participation, satisfaction and quality of life; i.e. Patient Reported Outcome Measures [PROMS]) and availability, access and satisfaction (i.e. Patient Reported Experience Measures [PREMS]) with care in order to inform policy and resourcing decisions at national and sub-national levels. For adults, this may include participation in work, while for children it may include participation in school. The wide-scale use of digital devices and wearables in many countries may enable rapid and scalable measurement of population health states and health behaviours in the future.
7.3	Surveillance outcomes should be disaggregated by age, sex and gender, geography, socioeconomic status and by the International Classification of	National health surveillance capability should include capacity for disaggregation of data by narrow age bands, sex and gender, geography, socioeconomic status and by the International Classification of Disease (ICD) and International Classification of Functioning,	National health surveillance capability should include capacity for disaggregation of data by narrow age bands, sex and gender, geography, socioeconomic status and International Classification of Disease (ICD) and International Classification of Functioning, Disability and Health (ICF) systems. Such disaggregation and systems for reporting are needed to determine local priorities by population group(s) and monitor responses across the life-course and broad range of musculoskeletal conditions in real-time (cross-sectionally) and over time (retrospectively and prospectively).

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	Disease (ICD) and International Classification of Functioning, Disability and Health (ICF) systems.	Disability and Health (ICF) systems.	

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Category 8: Research and innovation

Item	Compressed Delphi item (Round 2)	Delphi item (Round 1)	Extended commentary
Priority fields of research			
8.1	**Epidemiologic and population health research**: lifecourse risk factors; risk assessment tools; core outcomes for population health research.	Further evidence from epidemiologic and population health research is needed to: i) demonstrate the risk of developing MSK health conditions across the lifecourse; ii) develop risk assessment tools for MSK conditions; and iii) establish common core outcomes for internationally comparable population health research.	Research is needed to identify evidence for: • modifiable and non-modifiable risk factors for MSK health conditions across the lifecourse and by sex and gender; • the development of tools to simply identify risk of MSK conditions for use in clinical care and by the public; • a core set of outcome measures or indices for MSK health that can be used across countries in prospective population health research.
8.2	**Public health research**: public health interventions to shift health behaviours; impact of MSK health on other conditions; dynamic systems modelling to inform public health policy.	Further evidence is needed from public health research that examines: i) health behaviour change on modifiable risk factors in response to public health interventions; ii) how MSK health impairments or injuries impact on health outcomes for other non-communicable diseases; and iii) prevention-focused research using dynamic systems modelling to inform policy decisions.	Public health research is needed to: • examine health behaviour change strategies targeted modifiable risk factors and how MSK health impairments or injuries impact on health outcomes for other non-communicable diseases is needed; • evaluate prevention initiatives for priority conditions, such as MSK pain, through public health interventions and dynamic systems modelling. Such evidence is needed to inform policy decisions for prevention of MSK health conditions.
8.3	**Health policy and systems research**:	Health policy and systems research is needed to evaluate:	Priorities for health policy and systems research include:

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	implementation of MSK service models across contexts; strategies to reduce health inequalities and access inequities; development of MSK health classification system; effectiveness and acceptability of digital technologies to support MSK care and surveillance.	i) implementation of MSK health service models across different settings, economies and for different user groups (e.g. older people and younger people); ii) how systems can reduce inequalities in health and inequities in access to MSK healthcare; iii) the development and utility of classification systems for MSK conditions for use by health systems; and iv) the effectiveness and acceptability of digital technologies in improving access to care and surveillance of health behaviours.	• National-level implementation research on acceptable and (cost)-effective service and financing models, including innovative pilot programs, to support delivery of the right MSK care in primary and secondary care settings is needed. Such evidence likely needs to be collated from research using designs other than randomised controlled trials (e.g. mixed-methods research) with a focus on examining implementation feasibility and acceptability to people in different settings and in the context of other health priorities, local healthcare practices and integration with existing service models. For example, intrinsic capacity varies widely among older people, so service models that aim to increase functional ability need to consider such variability. • Research that examines how health systems can be influenced to support reductions in inequalities in health outcomes and inequities in access to MSK healthcare and how positive health behaviour change can be supported at the population level is needed. • Research is needed that supports the development and evaluation (acceptability and utility) of classification systems for MSK health conditions for use by health systems. • Health services research is needed to evaluate the effectiveness and acceptability of digital technologies in improving access to care and scalable surveillance of health behaviours.
8.4	**Clinical and basic science research**: mechanisms associated with MSK conditions, including persistent pain; curative therapies for MSK conditions; biomarkers, assays and diagnostic applications; and extend evidence for non-surgical and non-pharmacologic interventions.	Clinical and basic science research is needed to: (i) improve understanding of mechanisms associated with MSK conditions, including persistent pain; (ii) explore curative therapies for MSK conditions; (iii) explore new biomarkers, assays and diagnostic applications; and (iv) extend the evidence base for non-surgical and non-pharmacologic interventions for various MSK health conditions.	Basic science research should continue to pursue (i) improve the understanding of mechanisms associated with MSK conditions, including persistent pain (ii) curative therapies for MSK health conditions (supported by registries to monitor safety and effectiveness), and (iii) the exploration of new biomarkers for MSK diseases, assays and early diagnostic applications. In clinical research, there is a need to maintain and extend evidence for non-surgical and non-pharmacologic interventions for various MSK health condition. Such evidence is needed to inform clinical care and inform and health systems in service design and funding.

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8.5	**Health economics**: cost of MSK health conditions and injuries to communities and governments; cost effectiveness of treatments; cost effectiveness of integrating MSK health prevention and management within broader non-communicable disease care; and return on MSK health investment for other sectors such as workforce participation.	Health economics research is needed in relation to the following: evidence of the cost of MSK health conditions and injuries to communities and governments; the cost effectiveness of treatments for MSK health; the cost effectiveness of integrating MSK health prevention and management within broader non-communicable disease care and; the return on MSK health investment for other sectors such as workforce participation.	Key priorities for health economics research include: • Broad health economics research is needed to produce robust evidence concerning the scope and size of the cost burden of MSK health impairment to governments and the cost of the counterfactual argument of not taking any action. • Focussed health economics research is needed to produce evidence on the cost-effectiveness and system-level efficiencies achievable from integrating MSK healthcare with other health service models (e.g. non-communicable disease care). • Focussed health economics research is needed to produce evidence on the cost-effectiveness of new therapies for MSK conditions, using metrics such as Quality Adjusted Life Years (QALYs). • Health economics research is needed that shows return on investment for acting on MSK health impairment prevention and management to sectors outside of health, e.g. workforce and schooling participation, unemployment benefits, disability payments, long-term care services for older adults.
Capacity building in MSK research			
8.6	**Capacity priority 1**: support national-level MSK health research; multi-national and interdisciplinary research collaborations; and lower-resourced settings undertaking critical local research.	There is a need to increase capacity in MSK health research globally through supporting: national-level MSK health research, multi-national and interdisciplinary research collaborations and lower-resourced settings undertaking critical local research and participating in international research.	There is a need to increase capacity in MSK health research globally through supporting national-level MSK health research, supporting multi-national research collaborations and supporting lower-resourced settings to undertake critical local research and participate in international research (e.g. though postdoctoral fellowships). At a national level, countries with sufficient resourcing may consider establishment of dedicated MSK health research institutes to address national priorities/knowledge gaps in MSK healthcare, to support cross-discipline collaboration, and to drive research translation and dissemination.
8.7	**Capacity priority 2:** Support co-design of research by people	More deliberate co-design of research by people with lived experience of various MSK	Greater prioritisation for partnering with patient groups and clinicians is needed from the inception of research initiatives in order to identify research priorities and outcomes that are meaningful to local population groups. These partnerships are also critical to supporting dissemination and driving

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	with lived experience of various MSK health conditions and clinicians.	health conditions and clinicians is needed, as well as ensuring research includes vulnerable populations or minority groups.	strategic directions for national MSK health research. This is particularly important for vulnerable and minority groups where care disparities are often wider.
Funding for musculoskeletal health research			
8.8	Increase the proportion of research funding allocated to MSK research and allocate additional funding leveraged through public-private partnerships.	An increase in the proportion of research funding for MSK research and additional funding leveraged through public-private partnerships is needed for primary research and to support evidence dissemination and translation.	A greater proportion of research funding (from any source) needs to be directed to MSK research commensurate with the burden of disease, while specific additional research funding for MSK health research may be facilitated through public-private partnerships. Countries should identify national health priority areas aligned to burden of disease and target research investment with these priority areas. There is also a need to increase research funding for primary research in MSK health and also to drive dissemination and translation of research outcomes to inform clinical care, public knowledge and behaviours and health system reform initiatives.
Innovation and evidence translation			
8.9	Support innovation sharing between countries and between researchers and clinicians.	International co-operation and dissemination strategies are needed to facilitate innovation sharing between countries and between researchers and clinicians.	Establishing pathways and systems that allow countries to facilitate sharing of interventions or system innovations for MSK health are needed. This is particularly important to share innovation between high-income and low and middle-income countries to mitigate gaps access to research innovations.
8.10	Support research that harnesses the emerging potential of digital technologies and the collection and use of 'big data' and machine learning.	Research and innovation that harnesses the emerging potential of digital technologies and the collection and use of 'big data' and machine learning are important for exploring prevention opportunities for MSK health conditions and MSK pain.	Research and innovation that harnesses the emerging potential of digital technologies and the collection and use of 'big data' and machine learning are important for exploring prevention and management opportunities for MSK health conditions and MSK pain (e.g. personalised medicine, identification of personalised risk factors).

Supplementary file 12

SUPPLEMENTARY FILE 12

Supplementary file 12

Organisations represented in Phase 1

Global organisations

1. Global Alliance for Musculoskeletal Health
2. Health Systems Global
3. International Association for the Study of Pain
4. International Society of Physical & Rehabilitation Medicine
5. International Federation on Ageing
6. International Osteoporosis Foundation
7. Osteoarthritis Research Society International
8. Rehabilitation International
9. Société Internationale de Chirurgie Orthopédique
10. World Federation of Chiropractic
11. World Federation of Occupational Therapists
12. World Health Organization
13. World Physiotherapy (IFOMPT sub-group) (formerly World Confederation for Physical Therapy)
14. World Spine Care

International organisations (high-income countries)

15. Australia and New Zealand Musculoskeletal Clinical Trials Network
16. European Alliance of Associations for Rheumatology (formerly European League Against Rheumatism)
17. European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases
18. EUROSPINE

International organisations (low and middle-income countries)

19. African League Against Rheumatism
20. AO Alliance Foundation
21. Dr P.K Sethi Department of Physical Medicine & Rehabilitation

International organisations (mixed income countries)

22. Asia-Pacific League of Associations for Rheumatology
23. Community Oriented Program for Control of Rheumatic Disorders
24. Pan-American League of Associations for Rheumatology

National Ministries of Health

25. Public Health England

SUPPLEMENTARY FILE 13

Detailed commentaries and quotes

Supplementary file 13

Category 1: Engaging, empowering and educating citizens, communities, organisations and governments to act on MSK health

Item	Compressed Delphi item (Round 2)	Extended commentary with exemplar quote(s)
Priority sectors for pursuing engagement and forging partnerships to support prevention and management of MSK health		
1.1	Improving prevention and management of MSK health requires **engagement and partnerships** with: **1.1a** Citizens, patients and civil society organisations **1.1b** Industry, workplaces and employers **1.1c** Third-party payers/insurers **1.1d** Built environment sector **1.1e** Schools and education facilities	**1.1a Citizens, patients and civil society organisations**: Engaging and empowering citizens and patients to learn more about MSK health and act on prevention and management, such as through awareness campaigns, will be essential to achieving population health gains and reducing disability. Forging partnerships between governments and civil society/community organisations can be an effective mechanism to drive citizen and patient engagement, in particular for engaging with vulnerable groups; e.g. older adults and minority groups. *"So yes, we need this whole engagement of patients, how patients take care of their health is something of importance and if you look at other models, such as the diabetes model, it has been very good. We have not been able to engage people with musculoskeletal disorders in the same way at all. So, I think it's how do we engage the people who are in the schools, in the workforce and in the elderly population, so that there is a continuum on promoting and making advocacy for musculoskeletal health?" (ID4)* *"So, I think partnering with non-governmental organisations would support efforts to raise awareness, promote best practices and improve population awareness to good musculoskeletal health." (ID7)* *"Citizen engagement, it brings me back to what I was saying a little bit earlier around that public awareness and having that engagement, because unless you've actually had a musculoskeletal condition or you've suffered with pain as a result of an MSK condition you won't really appreciate it, I think. So that engagement piece needs to happen at a larger scale." (ID17)* **1.1b Industry, workplaces and employers**: Engaging with and supporting industry, workplaces and employers to act on injury prevention and management, support return to work after injury and implement workplace accommodations to enable people with compromised functional ability due to MSK health conditions to equitably participate in work will be important for maintaining national work productivity and financial security of individuals. *"the importance of effective return to work strategies within the workforce. I think that has been overlooked consistently over decades, so I think making adjustments and making sure there's appropriate support in the workplace and making appropriate adjustments and modifications for disabled employees has to be a priority. And I think we're seeing some signs of that, I think we're probably seeing a better picture of that in 2020 than we were in, I don't know, 1990, but I think if you're talking about policy change there needs to be proactive positive policy in order to support the return to work of disabled people so they can exercise their right to work and work in an environment where appropriate adjustments and the equity of opportunity is there." (ID7)*

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	1.1f National and sub-national governments.	**1.1c Third-party payers/insurers**: Engaging with health and industry insurers to prioritise MSK health in insurance schemes will be important to facilitate access to care and prevention and management of work-related injury. *Identified from policy review (no direct quotes)* **1.1d Built environment sector (urban planners and developers of residential and commercial buildings, open space planners, transport and road safety systems)**: Engagement and partnership with the built environment sector is needed to improve access to infrastructure; mobility, function and participation within built environments; and safety for people with MSK health conditions (e.g. being able to safely cross roads and exit residential or commercial buildings). In addition, there is a need to more optimally design urban open spaces to enable and encourage citizens to make positive health behaviour choices, such as the ability to safely play, recreate and engage in physical activity locally. *"We spoke of the transport system, but we are also speaking about if it's in the structural adjustments in residential and commercial buildings. We're talking about would I be able to get into my house if I'm renting an apartment somewhere? Are the facilities favourable for me to be able to move in and out? So, we're speaking about getting people involved even in the design and approval, because all the buildings have to be approved by the government. When they approve building plans, do they take care of the possibility that somebody could end up with an MSK condition? The same thing, even when people may not need that, but maybe as people are ageing, because we're also an ageing population, would somebody still be able to stay and live in that place, in that apartment or in that little house, on their own?"(ID3)* *"People who do not have secure housing, who do not have access to nutritious food, who do not have safe places to recreate and move, it's not like they're just making choices to not change their lifestyle; their environment is prohibitive of them being able to change their lifestyle. So there are things that can be done to change that too, like created environments, built environments can go a long way towards including musculoskeletal health that aren't ever going to be done in the clinic, they have to be done in the community." (ID8)* **1.1e Schools and education facilities:** Engagement and partnership with schools and education facilities is needed to support education about prevention and management of MSK health conditions and design environments and curriculum that support healthy behaviours for children, in particular, support for participation in physical activity and healthy eating. *"I think if we look at prevention I think it really starts at school. We do very, very little and, to my mind, it's not sufficient what is done, that is prevention at school, prevention in families. I think the key issues have to be addressed, like smoking and alcohol based on what we know, obesity and so on, especially obesity , I think it's a key problem and a growing problem." (ID14)*

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		"Education on all levels beginning really with children, teaching them in grade school what are the primary determinants of health? It's what you eat, drink, think, feel and do, and if you can manage those aspects you can do a tremendous amount for prevention." (ID22) **1.1f National and sub-national governments**: there is a need for whole-of-community engagement with national and sub-national governments to define MSK health and advocate for action on MSK heath given the enormous burden of disease and costs associated with MSK conditions and injury and trauma. Advocacy around threats to economic development and sustainability and return on investment is important in the context healthcare expenditure, work productivity loss and absenteeism, taxation revenue loss, social care payments and socioeconomic consequences for families and communities. *"I'm not sure at the moment, even now, whether we've done a good enough job in emphasising the economic burden of MSK disorders to governments and demonstrated well enough the potential benefits of investment in terms of disability prevention. So I think that's also an important area. I think we also know that costs are very largely associated with the people who are not necessarily the acute people but are the people for whom MSK disorders become chronic and I think that's where the real funding burden lies. But I think the cost is not just simply in terms of losses from a psychological and functional perspective to that individual. I think it's important to recognise that MSK disorders present a huge burden to families, to communities, and on a societal perspective, as well." (ID7)* *"..you can't educate the population until you've educated the government. I think also the help from education at that national governmental level and also I think the strategy, a part of that education needs to include what are the benefits? So what's the benefit of the Australian government having a 70% reduction in opioids? I mean, you and I can see it as plain as the nose on your face, but sometimes we have to convince the government to then convince the population to then enact a strategy." (ID25)*
Priority sectors for public education		
1.2	Improving prevention and management of MSK health requires **public education** across the following sectors: schools and higher education facilities; workplaces; health professionals; and the community.	**Priority sectors for public education** • In schools and higher education facilities prioritise education about MSK health and its importance across the lifecourse and a contemporary understanding of pain. *"So I certainly think we need to do more in schools to be able to educate young people around the value of their musculoskeletal system and what they can do as they age to look after that. I certainly think we need to help them understand that there are things that can be done if you strike up some sort of an issue with your musculoskeletal system, and this includes pain as well. So we need to have a better understanding of pain when we're young because pain is our body's response to a lot of different things that go on, but it doesn't always mean we have to stop and do nothing and build up this massive amount of fear around what's going on with our body. Pain is basically just our body giving us a message around something that we need to be aware of, but obviously there's things that can be done. People don't understand and we need to educate our youth." (ID12)*

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		• Educate industry and workplace insurance providers how workplaces can prevent MSK injury (e.g. through risk identification and mitigation), support healthy work habits (e.g. through promotion of movement and activity) and support people with MSK health impairments to maintain productivity and return to work. In this regard, workplaces can be used as an effective portal and model for public health education. *"I've always thought that we underutilise the capacity of the workplace to give health education. Unfortunately, I think this has had some consequences. I think Japan has been one of the leaders to implement, for example, stretching exercises in many of the companies and it became a national leader on that. I think that it's also very cultural if you look at, for example, some countries that have recommendations, but they may not be implemented. If we go like "a healthy workforce gives a healthy company" it's hard to understand why we don't have more incentives to implement this in, for example, the workforce." (ID4)* • Support the dissemination of best-practice evidence for prevention and management of MSK health and injury to educate the health workforce at scale. *"The other area that I mentioned earlier was the scaling and the spreading of the best evidence that's available, because we know, don't we, that often clinicians, we're guilty, and especially I've worked in the Middle East for a while and I've realised that people will just carry on doing the same thing that they were trained to do God knows how many years ago and they're not coming online with best practice. So, scaling up of the best evidence and the best practice." (ID17)* • Society and community at large (including government and policy makers), including tailored messages and approaches for vulnerable groups (e.g. those of lower socioeconomic status, people with intellectual and/or developmental disabilities, people in rural settings, ethnic minority groups): o Educate society/community at large concerning the importance of MSK health for living well (i.e. functional ability and socioeconomic security and welfare across the lifecourse), so that the value of MSK health is better understood and misperceptions are corrected. *"So a health first approach of how to promote a healthy population. The goal of that would be to have a healthier population that is more resilient and knows how to look after themselves, they know how to triage themselves, and they may also have less fear about the things that they're feeling in their bodies because they'll have a certain level of knowledge and comfort of what goes on in their bodies." (ID22)* o Educate society/community at large concerning exposure to modifiable risk factors for MSK health loss, including physical inactivity, obesity, malnutrition, smoking and how to adopt and maintain positive health

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		behaviours to achieve better MSK health and quality of life. Education needs to also focus on early detection and intervention for both disease features and unhelpful behaviours. This is particularly relevant in resource-limited settings. *"You know, Africa is poor, we can't afford the curative aspect because it's costly. We can't afford that, so what we need to invest in are the preventative aspects, so working on the preventative aspect could be easier for poor countries, like African countries. For example, investing in awareness of activities, promoting a healthy lifestyle like doing regular exercise, promoting healthy food and things like that would help." (ID30)* ○ Educate the society/community at large to address misconceptions about management of MSK health conditions and MSK pain. Specifically, provide education about what is the right care for MSK health conditions and MSK pain, the role of early detection and treatment and a contemporary understanding of pain. *"So I think that one specific priority is education for patients about pain. We need to educate, we need to inform the general population about pain. Probably we can decrease, for example, over-utilisation of the health system by the patients. We need to change the misconception that okay, it's very, very important, but we need to change the utilisation of the health system." (ID28)*
Priority messages for public health education about MSK health		
1.3	Improving prevention and management of MSK health requires globally-relevant **educational messages** contextualised to local settings.	**High priority messages include**: • MSK health enables function, participation and enjoyment across the lifecourse, with the impacts of impaired MSK and persistent pain profound and wide reaching, including increased risk of mortality. This message should be supported by concrete examples and metrics that are locally relevant and understandable by the general population. *"Also what the health consequences are of not paying attention to musculoskeletal wellbeing. I think that good MSK health needs to become a habit in the lives of people in society, I don't think it is a habit at the moment, but changing habits we know is a protracted process and it needs to be associated with better evidence of benefit. I think, as well, if you're going to persuade a society to change their habits it also needs to be associated with some form of tangible reward, so we've got to sell it to people." (ID7)* • Physical activity, play, sport and movement are essential for good MSK health, mobility, function and preventing multiple diseases. *"Maybe we need to show some goal or objectives as physical activities for achieving a long lifespan, such as 8,000 steps per day is*

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		necessary or something like that. The number is very important to make people understand the importance of the activity." (ID1) *"…but educate people that actually play is important for your long-term health. People kind of know that but they're not thinking about MSK, they're thinking about heart disease and diabetes." (ID6)* • MSK conditions and MSK pain are relevant across the lifecourse - they are not an inevitable part of ageing and they impact young people too. *"Arthritis is something that affects more people under the age of 65 than over the age of 65 and yet we still look at it as an old person's disease. This all comes back to the fact that we do not educate our population enough on what this issue really is." (ID12)* • There are effective strategies to manage many MSK health conditions and MSK pain to improve function and quality of life. Interventions are most effective when they are introduced early and coupled with positive lifestyle and behavioural changes. On the other hand, there are also many interventions that are less effective and potentially harmful (low-value), particularly for long-term MSK pain where the experience of pain may not be related to musculoskeletal structures. *"The societal narratives that we have around pain in musculoskeletal conditions are not helpful either and those are everything from the medical narratives that we hear, that for so long have been pain is damage or some type of lesion that can be found on a scan or in an image and then we go in and we fix that with a pill or an injection or a block or surgery." (ID8)* • MSK health conditions are the most significant global healthcare problem in terms of disability (activity impairment and work loss) and cost to individuals and communities. *"We do not take musculoskeletal health seriously enough. As the figures have shown over recent times, it's one of the biggest costs to the healthcare system and yet we're doing nothing about prevention or education of both the population and our health professionals as to what can be done to avoid this going forward." (ID12)* • MSK health is not just about diseases. The majority of trauma, sporting injuries and workplace injuries are musculoskeletal in nature. *"We also can link our message to trauma. Musculoskeletal trauma is probably the major traumatic event, but when people talk about motor vehicle accidents they rarely talk musculoskeletal. I mean, clearly, musculoskeletal is where the injury occurs in 90% of the cases, except for head trauma and a few others, but it's usually musculoskeletal and yet you never see motor vehicle accidents*

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		under musculoskeletal disease in anybody's categorisation...It's always reported separately. Same way with industrial injuries. 80% of industrial injuries are musculoskeletal, but yet if you look at common statistics it is always separated from musculoskeletal. So there's a whole series of messages that we can link our message to and make musculoskeletal much more visible and also add to the preventative story. Messages that prevent motor vehicle trauma, industrial injuries, diabetes and many other disorders should be part of that the MSK story. We should not think of MSK disorders as separate from the general health story." (ID10) • Many MSK health conditions and injuries can be prevented by raising awareness about modifiable risk factors and screening for some MSK conditions. *"The other issue linked to public awareness is the public messaging. I guess if you were to ask somebody what are the key risk factors for cancer or CVD in the UK I know people would instantly be able to tell you, but if the same question was asked of MSK how many people could tell you the answer?" (ID17)*
Priority enablers to drive advocacy and support community-wide education		
1.4	Use mechanisms to drive public education, including: empowering people with lived experience to share stories and co-design messages; mass and social media; peer support models and engaging civil society and professional organisations.	**Priority enablers to drive advocacy and support community-wide education**: • Empower people with lived experience, including children and their families, from different settings and with different conditions and injuries to share stories relevant to local and cultural contexts and co-design messages. Importantly, lived experiences should also reflect vulnerable and minority groups. *"So the advocates being the patients, being the ones who've been through really good care in different settings, who've addressed different challenges in different ways and telling people positive stories which bring out the challenges, but in a way that, actually, it can be done." (ID6)* • Leverage mass media and social media to disseminate education and advocacy messages. *"These days with social media, that might be the platform, but they've got to be stories from different parts of the world addressing different challenges . Maybe someone who lives in a remote island in the middle of nowhere who got some treatment through telehealth, for example." (ID6)* • Peer support models and group-based education, relevant to the local context, to support people with long-term MSK health conditions. *"One thing I think is so underutilised in the pain world in general is peer support groups and peer-to-peer education support and resources, so I think any kind of global strategy should include peer support as a part of that too. It's been done really well in other*

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		areas, like addiction recovery, even in diabetes and cancer and they're really strong peer support groups." (ID8) • Support and resource civil society, such as national or sub-national advocacy organisations, to champion advocacy and education initiatives and empower and support patients, governments and society with accurate knowledge about MSK health conditions, their prevention and management, and strategies for system reform. *"It helps a lot if there are champions, because in the past years conditions of people with disability would not usually get that much attention. But here, for example, in the Philippines for the past years we've been actually funding and creating benefit packages for people with disability and children with disability. Why is that? Because UNICEF picked it up as an agenda and they worked with civil societies, who have already done a lot of groundwork in terms of disability." (ID27)* • Empower and support professional clinical associations to assume advocacy roles and foster relationships with their national government. *"So EULAR is formed of a whole number of national societies of doctors, of health professionals and of patients, and I think that last piece is really important. The core structure of EULAR is actually built around its health professionals and patients. We have inherently worked across different national governments and with the national societies, we work very carefully with the EU, we use an agency in Brussels for that purpose. Prompted by a whole variety of political developments in the last two or three years in Europe, we're also working hard now to extend our political reach to other governments within the EU, but also within the EULAR countries, if you like. So at the European level we've used agencies to assist us with advocacy but, increasingly, we're investing in our own secretariat and that is the, if you like, in-housing of capabilities that will allow us to really be effective advocates for our patients." (ID15)*

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Category 2: Leadership, governance and shared accountability

Item	Compressed Delphi item (Round 2)	Extended commentary
Integration with existing policy and system strengthening reforms		
2.1	MSK health should be explicitly integrated with broader reform efforts for non-communicable diseases (NCDs).	MSK health conditions and MSK pain are not adequately integrated with non-communicable disease (NCD) prevention and management policy and financing in a manner commensurate with their established burden of disease. The focus on mortality reduction in NCD reform deprioritizes the disability burden associated with MSK conditions and persistent pain. There is an urgent need to more explicitly integrate MSK health conditions and pain with broader NCD reform efforts by national governments, with guidance and leadership from the World Health Organization (WHO). Given the shared risk factors and shared management strategies between many NCDs and MSK health conditions (e.g. smoking, alcohol use, nutrition, obesity, physical activity), integration and strategy alignment would serve to positively impact not only MSK health conditions, but also other NCDs. This is further reinforced by the fact that prevalent MSK conditions are a risk factor for developing other NCDs. *"I think that while there's been a shift towards greater awareness of NCDs generally, I don't think this has included in any meaningful way MSK disorders which, despite being the cause of widespread disability and consequent inequality and inequity, I think they've been overlooked in favour of cancer, heart disease, diabetes and stroke, you know, the big four when it comes to that." (ID7)* *"Well, what needs to be done now is that it can't be the elephant in the room anymore. Musculoskeletal health has to become level with the other big NCD areas because there are so many commonalities and if we include musculoskeletal health into a lot of the existing and ongoing strategies, that's a win-win." (ID2)* *"NCDs get a lot of attention from Member States, but I don't know if all the Member States understand musculoskeletal health is part of NCDs. When they say "NCD" they mean diabetes, hypertension, so it's very important to highlight this aspect in terms of mobility, musculoskeletal health and also pain. I don't think they recognise pain as a type of NCD." (ID24)*
2.2	Universal Health Coverage (UHC) essential care packages and/or insurance schemes should include prevention and	Healthcare (prevention and management) for MSK conditions, pain and injury should be guaranteed in all countries through Universal Health Coverage (UHC). This is warranted due to the disability burden imposed by these conditions and the prevalence of MSK health conditions in co- and multi-morbid NCD health states where it is usually the MSK condition(s) that is the main contributor to disability. In countries with health coverage through established public, private, social or statutory insurance schemes, coverage for MSK health should be included.

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	management of MSK health impairment.	*"Musculoskeletal health should be guaranteed in all countries as universal health coverage, because osteoarthritis if not treated can give you the same level of disability as a stroke because the person might not be able anymore to go outside his home or work by himself. And sometimes these conditions are also related with other neurological conditions, for example, old patients with Parkinson's. It's very common that apart from the Parkinson's they also have another musculoskeletal condition, like osteoarthritis, that reduces their ability to move. They just take pills for the Parkinson's, to control the Parkinson's, but they are not actually doing any physical exercise to maintain their level of physical mobility. Then, in the end, they are not able to walk anymore, but not from the Parkinson's, it's just because they have developed hip osteoarthritis that is due also to the non-use, I mean, of the joint." (ID29)*
2.3	Strategic global responses for MSK health should explicitly link with and support implementation of existing global and national health system strengthening efforts.	A global strategy for MSK healthcare, pain and injury should explicitly link with and support implementation of existing global and national efforts in health system strengthening, for example in care integration (e.g. *WHO Framework on integrated people-centred health services*), ageing (e.g. *WHO Global strategy and action plan on ageing and health*), rehabilitation (e.g. *WHO Rehabilitation 2030* agenda), disability (e.g. *WHO Global disability action plan 2014-2021*) NCD care (e.g. *WHO Global action plan for the prevention and control of noncommunicable diseases 2013-2020*), injury prevention and trauma care. *"I think it needs to be integrated at the level of care with NCDs and interlinked to Rehabilitation 2030. Healthy Ageing is really the entry point also for advocacy because there you have the prediction of the increasing numbers, but I think in terms of more than that it's really establishing the linkages with each of the other strategies." (ID20)*
Global and national leadership to prioritise MSK health, pain and injury prevention and care		
2.4	***Global leadership*** from the World Health Organization (WHO) in prioritising MSK health is essential to drive a global response to the burden of MSK health impairment.	Global leadership from the World Health Organization (WHO) in prioritisation of MSK conditions, pain and injury is essential to catalyse a global response to the burden of disease, particularly in low and middle-income countries (LMICs) and to inform the strategic activities of global clinical organisations. In this regard, there is a need for a global Strategy, Action Plan or Guideline to help Member States initiate appropriate policy, financing and health service reform initiatives and for clinical organisations to prioritise their efforts in global reform and advocacy initiatives. *"For example, if one strategy is developed by some other international organisation, for example International CSO [Civil Service Organisation] the government might consider it, but if it is through the WHO they unconditionally accept it and they work wonders in achieving that strategy, implementing that strategy. I can even mention an example. In Ethiopia, rehabilitation was not part of the health system, it was under the Ministry of Social and Labour Affairs. But now, because of the push from the WHO in making rehabilitation part of the health system, they are trying to do some changes and as of last year rehabilitation became part of the health system and now it's under Health, it's not under the Social and Labour Affairs Office." (ID30)*

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		"Yes, I believe that if that top-level strategy came from the WHO and trickled down - actually, maybe "trickled" is not the right world to use here. I think it needs to come down more forcefully, more authoritatively. It needs to come down through all the right channels with a proper and co-ordinated flow." (ID31)
2.5	***Country-level*** leadership is needed to prioritise MSK health impairment by national governments.	National leadership is required to advocate for prioritisation and action on prevention and management of MSK health and injury by governments, commensurate with their established burden of disease across the lifecourse. To increase prioritisation of MSK health by government there is a need to communicate the disease burden to all governments, relative to other health states where larger proportions of health resources are currently directed by MSK champions. National governments need reliable evidence on the local burden of disease and cost data in order to catalyse leadership for local system reform and to work collectively with other governments to advocate to the World Health Organization (WHO) to act on MSK health. In particular, national leadership in advocacy and policy formulation that emphasises the importance of MSK-related disability prevention on human capital and economic development (e.g. return on investment) is needed. Leadership activity should extend beyond advocacy to include the establishment of local systems to facilitate decision-making; e.g. responding to new evidence. Structurally, this may include establishment of appropriately regulated expert advisory groups/taskforces, or stakeholder committees within and/or across the health system in partnership with civil society partner organisations. *"… the country governments should embrace that very strongly, because if they do not believe that musculoskeletal conditions are important then nothing will happen. I think we have very good experience with HIV. I think once everybody realised and then you put programs everywhere and there was money that went into that and that improved their life a lot. So I think we need that. You need that each country believes in that and really embraces those ideas." (ID13)* *"For example, for a WHO Global Action Plan the needs to come from member states, why this is needed and why this is required. So it's very important to highlight, for example, with a position paper or something like this why this is important for the Member States, what is the burden, what are the consequences if we don't work on it now?" (ID24)*
2.6	Leadership is needed from ***professional and civil societies*** and citizens that extends beyond just MSK health.	Collaborative engagement and consultation between professional/clinical and civil society organisations and citizens across the health sector (i.e. beyond just MSK health and injury groups), with national governments and the WHO is needed to advocate for the prioritisation of MSK health and injury prevention and management in national health reform efforts. *"we need a very collaborative engagement strategy to ensure that all of these players are on board singing the same tune and it's not just the people working in musculoskeletal health; it's all of those different organisations that recognise that risk factors for chronic disease in general are pretty much the same. It's about staying active, it's about watching your diet, it's about good mental health*

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		strategies, all of these things contribute to making sure that we keep our musculoskeletal system as viable as possible for as long as possible." (ID12) *"So I think a multisectoral partnership within the country where all the stakeholders would come together, the public, the private sector especially and citizens, if they get engaged I think that would help push country's response and overall activity in the countries." (ID19)*
2.7	Global and national ***multi-sectoral and inter-ministerial leadership*** is needed to prioritise action on policy and financing for MSK health.	Global and national leadership across sectors and government ministries (i.e. beyond the health sector, e.g. social care, industry, sport, transport) is critically important to elevate the priority of MSK health prevention and management to government, industry and private organisations. Multi-sectoral and inter-ministerial leadership in MSK health will facilitate better integration of prevention and management initiatives across public policy and financing, which is essential to achieve impact. At the government level, leadership may include specific Ministerial responsibility for MSK health and the establishment of dedicated focal points in national governments and global organisations for MSK health. *"But it's right from the top of leadership at government when you're going through the healthcare delivery system and wider in employment, so all the various government departments, you see that musculoskeletal conditions are recognised as one of the potential risk factors that they need to take on board, because it has an impact on not only the economy but also on health outcomes and a whole range of other stuff." (ID17)* *"One is the national leadership and capacity-building in the sense that if you look at a country like India, I looked on the email as well and there's a desk missing for musculoskeletal, who'll address the musculoskeletal conditions in general. Things have improved to a level, trauma care is getting some visibility, but I think the countries in the low and middle income world need to build their capacity at the national governance level so that they have an office or desk or unit or individual at the governmental level who can be identified . Maybe he is multitasking, but there is no dedicated policy desk or office to look after musculoskeletal conditions. So I think that is the first thing that they need to consider, building their own capacity first so that they understand how important it is to look after the population who are suffering from chronic musculoskeletal conditions." (ID19)*
Measurement and classification		
2.8	Global and national health and performance indicators must extend beyond mortality reduction to consider function and participation.	Measures of health and performance in health reform must extend beyond mortality reduction and consider function/participation restriction and recognise the health and economic benefits of disability prevention. An expansion in targets and performance measures to recognise function and participation will better support systems strengthening for MSK health. "I'd say the first priority should be a change in our attitude. Whenever the WHO fixes up their priorities, they look at mortality, but they don't look at disability. Disabilities are associated with workloads, loss of income at an individual level, a national level and also a global level. So, I would say the issue of disability must be given priority side by side with mortality and MSK conditions must be included in

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		the NCD priority list. They must be listed, because the disability burden due to MSK conditions is much higher than the fatal conditions, the communicable conditions." (ID5)
2.9	A meaningful, acceptable and internationally comparable classification system is needed for MSK health.	Countries need to classify MSK health states into meaningful diagnostic categories rather than symptomatology alone, supported by guidance from WHO and in alignment with the International Classification of Disease (ICD) system, in order to make sense of the wide constellation of MSK conditions. Such classification is needed to design appropriate local models of service delivery, workforce configurations and financing to support care pathways for different classifications of MSK conditions. Without classification, the scale of the problem is too large and too complex to initiate meaningful action, particularly for lower-resourced countries. Classification also enables countries to prioritise responses to specific groups of MSK conditions based on national need. *"Yes, the taxonomy is unclear, precisely what people are dealing with is unclear, and it's absolutely key that some account is taken of the diagnostic categories, rather than purely symptomatology . A strategy addressing widespread pain would, in my view, be a mistake. A strategy that incorporated widespread pain as one of the many things that you talk about in musculoskeletal, that would be a much wiser approach." (ID9)* *"I think MSK disorders are too big a problem unless we focus, first of all, on defining subcategories. I think anybody who has a global idea of treating musculoskeletal disorders, is performing a pointless exercise. It's not even remotely possible. You have to define what you are including under the broad category of musculoskeletal disorders." (ID10)*
Legislation and regulation		
2.10	Legislation and regulation are needed to sustain reform efforts in health system strengthening for non-communicable diseases, including MSK health.	National legislation and regulation to support long-term health system strengthening for non-communicable diseases (NCDs), including MSK health, is needed to sustain efforts with successive changes in governments. This will be particularly important in the wake of COVID-19 as priorities shift to communicable diseases. *"I think legislation that specifically highlights the needs for MSK needs to be increased. When I speak of legislation it's because when the legislation is passed it's likely to be there, to not be ignored, but if it's just a policy, sometimes the policy can be ignored by an incoming government. The government changes every so often and if they do not feel that this particular agenda is not something they want to pick up it can be ignored, but as long as the legislation is there it will be a backbone and we can always take it back to the government and tell them this is what you're committed to, so we need this provision." (ID3)*

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Category 3: Financing

Item	Compressed Delphi item (Round 2)	Extended commentary
Integrated financing models		
3.1	Existing healthcare financing models need to integrate health promotion and health care delivery for MSK health.	Existing healthcare financing models need to accommodate health promotion and health care delivery for musculoskeletal (MSK) health conditions, MSK pain and MSK injury in multidisciplinary models. This may be achieved in financing for health promotion, non-communicable disease (NCD) care, injury and trauma, or ageing and long-term care. Integrating funding for MSK health care with other established funding priorities will be important, particularly in the context of COVID-19 where new funding streams will be extremely limited. In the context of global burden of disease data, there is a strong rationale for an increased allocation of funding for MSK health. *"I think if we're looking at the risk factors in terms of prevention specifically, then we share more or less the same risk factors with CVD or cancer and other long -term conditions. So in order for it to really be, I guess, a reality it needs to be integrated into that approach of financing and looking at it as a whole long-term condition or NCD." (ID17)* *"I think there definitely needs to be a concerted effort at governmental level to prioritise MSK disorders within health systems globally. This means that budgets must contain dedicated provision for the prevention and management of MSK disorders at every level. Whether it's primary care, community, tertiary level, secondary, at all levels I think there needs to be a proper concerted focus." (ID7)*
Flexibility for different financing models		
3.2	Financing models for MSK health should accommodate flexibility for public-private partnerships, partnerships with civil society, international aid, tagged donorships	Financing models for MSK health promotion and care should accommodate the flexibility for public-private partnerships, partnerships with civil society, international aid, tagged donorships underpinned by appropriate regulation to avoid unhelp commercial influence and conflicts of interest, and the option for specific revenue-raising through taxes for specific purposes, such as supporting care of the injured through workplace taxes or transport/fuel taxes. Flexibility in funding models is also important to enable health systems to respond to emerging innovations or technological advancements that may improve health outcomes. *"Then we can also encourage, because even as much as we put the burden on the government, the private sector is also able to chip in. So here I was saying that one of the ways is to also solicit co-operation between the private sector and the government and other international agencies, however, with some caution in the sense that we also don't want to create conflicts of interest." (ID3)*

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	and revenue-raising strategies.	*"I think there are a number of ideas where you can finance the care of the injured, maybe if you can add a cent or two onto fuel, then that tax can be used for the care of the injured. Similarly, the tax on the automobile industry can be used to promote the care of the injured and so on and so forth. So I think there are conditions like injuries within that group which can have a different finance model, but for rest of the conditions I think we need to search for alternative financing models like, as you said, the third party peers or insurance or government health system taking care of the burden of, say, arthritis or back pain." (ID19)*
3.3	Support multi-national foreign aid for MSK care in low resource settings.	Multinational foreign aid is needed to support MSK health prevention and care in low resource settings and where basic care for MSK health cannot be sustainably delivered due to competing health priorities and limited resources. *"But I think that yeah, multinational collaboration is very important. I think they should try to improve - I work a lot with the local people, I see very many multinational initiatives where the big money - I don't know, this might not be politically correct, but the big money and everything stays in the countries that are developing the initiative. You do the work and you don't see much of what is going on. When somebody asked me last year at the ACR, "What can we do? We have a lot of initiatives that are global, what can we do to help you?" Well, give us money. We don't need ideas, we don't need professors, we can teach, we can do most of the initiatives you have in mind. We can do them, but we don't have the money to do them. So I think if you ask me what multinational initiatives should look like, well, to give money to us to do the things that we can plan together, that would be my view." (ID13)*
3.4	Allocated funding, essential medicines funding and donor funding for MSK health and injury care need to be quarantined.	Governments need a specific budget allocation for prevention and management of MSK conditions and the ability or regulation to quarantine donor funds for MSK health services, particularly to ensure access to essential medicines in lower resourced countries. *"Well, I definitely think that we need to match government funding with the level of burden of disease. Burden of disease I know in Australia, - and I'm not as over other countries - but the burden of disease for musculoskeletal health when you take everything into it, from inflammatory to osteoarthritis, to back pain and all the other ones that are measured we're like number two on mental health, and yet the funding that goes into musculoskeletal health is nowhere near that. If you look at the NHMRC funded grants over the past few years, it's a drop in the ocean compared to the burden of disease which is almost directly relatable to the cost to the health system. It is insane the amount of money that we are not getting to do something about this burden of disease. So I think that that's got to be addressed and it's very hard for the WHO to enforce or to recommend that governments do this when they don't themselves." (ID12)*
Financing for the right care, by the right team, in the right place		

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3.5	Financing for MSK healthcare should cover well defined, high-value (effective, safe, affordable) packages of care for prevention, diagnosis, and management, particularly for community-based interventions.	Financing models, particularly for low and middle-income countries (LMICs), should be formulated to support essential packages of care for MSK health conditions and injury, where funding of treatments and prevention strategies should be based on evidence, safety and cost effectiveness, targeting low cost and high yield. Ideally, these funding packages should be part of Universal Health Coverage essential packages and other locally relevant insurance schemes to minimise or remove out-of-pocket expenses. Packages should be tailored to different levels of the health system from community care through to tertiary care. Initial priority packages of funding should be directed towards interdisciplinary community-based care where out of pocket expenses are minimised or removed. For LMICs in particular, efforts to integrate packages of MSK interventions with established packages (e.g. 'Best Buys' for NCDs) should be prioritised to maximise return on investment across conditions. *"I think when it comes to MSK, any direct interventions must look to be low cost but are potentially high yield and certainly in Botswana, at a community-based level, something as simple as a patient yoga program has shown to be effective. So I think it's important to engage the community and have a strategy where people are motivated and recognise the importance of musculoskeletal health." (ID7)* *"The essential care packages I think may be structured around what a primary care facility can offer, or secondary care facility can offer and what a tertiary care facility can offer. So clearly there'll be different skills, expertise associated, and human resources required for different conditions, that is one part." (ID19)*
3.6	Financing models should incentivise prevention and integrated inter-disciplinary care for MSK health conditions.	Financing models should incentivise prevention (based on established modifiable risk factors) and integrated, interprofessional care for MSK health conditions so that a continuum of care is supported, as well as care between health settings and service providers. *"I think incentives should be reflected - in my experience, whenever I work in a team it's much better than if I have no dialogue with the others. But probably we as [rehabilitation] physicians are in a weak position because we depend on the work of health professionals, because we prescribe physical therapy, speech and language therapy, occupational therapy, and we really depend on the ability of these other people. So, whenever we manage to have a dialogue with the people we work with, I think it's always better, because we can really follow the patient and understand what they're doing." (ID29)*

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Category 4: Service delivery

Item	Compressed Delphi item (Round 2)	Extended commentary
Care at the right time: early diagnosis, triage and intervention for secondary prevention		
4.1	Service models for MSK conditions need to support early diagnosis and triage and management through local care pathways.	Service models need to promote early diagnosis and triage into appropriate, locally-supported care pathways that include referral systems to provide emergency or urgent care (e.g. trauma) or specialist-level care when indicated to arrest chronicity and disability, especially in younger people and those with inflammatory diseases. *"I believe that the first and foremost component of any MSK management care pathway has to be triage and determination of which class of MSK disorder best describes the persons presentation. If you don't triage into one of these classes or categories, you've no idea what you're going to do. This in turn leads to ordering unnecessary or unavailable testing and inappropriate referral." (ID10)* *"The education and rehab and, actually, the other bit is to think about even if we haven't quite got that prevention and we're looking at management, early management. Again, it's critical that that happens early because we know about persistent pain, we know that actually if we can get in there early we can prevent that. So, it's all about that early intervention." (ID17)*
Delivery of the right care: effective, safe, affordable and accessible		
4.2	Local care pathways should support essential packages of affordable, effective and safe care for MSK health impairment, while de-adopting care that is not supported by evidence, is costly and potentially harmful.	Service models should promote the 'right care', that is effective (evidence-based), safe, affordable and accessible care, through locally-supported care pathways that enable interdisciplinary care and access to tertiary or specialist-level care when needed, particularly in areas of high need/limited access. Care pathways and their components may be derived by defining essential packages of affordable and effective care for established classifications of MSK conditions and injuries, with an emphasis on low cost and high yield interventions, which in many cases will be non-surgical care outside the context of trauma. Low value diagnostic tests and interventions should not be recommended in essential packages for funding and should be defunded. Coupled with the formulation of care pathways and essential care packages is the need for building workforce capacity to provide the right care. *"I think the concept of putting together a package, as you put it, is very attractive. We have a program here for low back pain, for example, that directs patients from a family physician into a program where they don't get an MRI, they don't see a spine surgeon, they have a focused exercise program, they've been assessed by a specialist physiotherapist, and we've been able to use a package like that to decrease the volume of MRI by about 90%, a huge saving, and gotten rid of all the billing from surgical consultants for unnecessary visits and that kind of thing. So, we have developed this and we have developed what we call assessment centres for people with hip and knee arthritis to avoid unnecessary specialist visits and to have them directed towards appropriate non-surgical care." (ID26)*

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		"I think effective models of care have to address the limitations and also overreliance on medicines and technologies. You mentioned essential medicines and technologies, but in MSK care in particular I think that's a double-edged sword. If you increase access to opioids, to anti-inflammatories, to other medicines that have been typically used in the management of MSK, which have been shown and demonstrated to be less than effective and where the risks outweigh them, I think it could be a double-edged sword giving people more access to ineffective interventions." (ID7)
4.3	Services for MSK healthcare should be integrated with service models for non-communicable diseases (NCDs) and services that target the broader social determinants of health.	Services for MSK health conditions, pain care and injury care should be integrated with existing service models for non-communicable disease (NCD) care and service initiatives that target the broader social determinants of health. In some settings, piloting such integration may be warranted to produce data on satisfaction, cost and health outcomes. In this regard, MSK health should be considered as an important component to holistic, person-centred care healthcare. This is justified on the basis of the high prevalence of MSK health conditions in co- and multi-morbidity health states for NCDs and the increased risk of developing NCDs on a background of MSK health impairment. *"The prevention of musculoskeletal disorders also has a good effect on other diseases, such as cardiac and pulmonary diseases. If we go for education and exercise, for example, they have a positive effect on diabetes, so it takes into account all the comorbidities also." (ID4)* *"The other thought comes in terms of the lack of, or poorly integrated into, other conditions. So, it's the whole aspect of taking a more holistic person approach when we're thinking about an individual or populations, for that matter, as well...So that whole person approach is really important and then also, as a system, what strikes me is the lack of integration of MSK into a more system-wide health approach." (ID17)*
4.4	Evidence-based diagnostic and therapeutic practices should be prioritised in service models over approaches that are not supported by evidence, are costly and potentially harmful.	The overuse of technology in MSK care in high income countries (e.g. the overuse of musculoskeletal imaging) has been associated with, overall, limited clinical benefit in health outcomes and may promote unhelpful behaviours and beliefs about MSK health and pain care by patients and the broader community. A focus on delivery of safe and effective diagnostic (e.g. imaging) and therapeutic interventions (e.g. safe use of medicines and appropriate indications for surgery) is needed. This may be supported with global and country-level tools such as guidelines and quality standards. *"With that, of course, also goes access to technology. One of the big burdens on health systems has come about really because of the access to technology and in MSK we know that people are over-imaged when it comes to X-ray, we know that people are over-MRI-ed or over-CT-ed." (ID7)* *"We also know that the findings, the diagnostic imaging as such is adding to the problem because lots of people get unnecessary diagnoses that really are irrelevant to their personal capacity and they don't add much to the diagnosis, but it creates fear avoidance and people start distrusting their bodies. It creates a lot of insecurity, so that's another area where we can do better by being more restricted." (ID2)*
4.5	Service models for MSK conditions should support	Services models that promote integrated, interdisciplinary person-centred care and that target functional ability through a biopsychosocial management approach are needed to shift from a purely disease-focussed and biomedical paradigm.

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	integrated, person-centred care that targets functional ability through a biopsychosocial approach.	*"I also take, as a general view, that a lot of the measures taken against musculoskeletal problems fail because they are based on more like the traditional disease model and they don't address the disability issues, which when you analyse closer are really the greatest challenge. People don't die, but they're not able to work, they're not able to socialise, they get a lot of comorbidities from not being able to move. So, I think we're doomed to fail at the moment. We are trying to treat this as a disease with drugs and surgery, the traditional model, and not addressing the disability, so we have to find new ways." (ID2)* *"I think we've become so specialised and so focused. People who treat knees, I'm like, no, you don't treat knees; you treat people with knees. That knee is always a part of a person, it's always attached to a person. You don't specialise in hips; you specialise in people who have hips. You don't even specialise in those people; you specialise in working with people who have problematic hips. So, there's this really narrow focus in that kind of body as a machine metaphor that is really, really common in medicine and we need to change that to the body as an ecosystem." (ID8)*
Delivery of care from the right team: interprofessional service models		
4.6	Service models for MSK healthcare should promote community-based interdisciplinary care.	Service models for MSK conditions should promote community-based interdisciplinary care tailored to the needs of the person and grounded in common standards of care delivery across providers. In some settings, primary care may be best triaged and coordinated by trained MSK practitioners or other local providers (e.g. family physicians, paramedical workers, local healers, female health workers) where there are access limitations to specialist medical practitioners. Service models should also enable timely access to tertiary and/or specialist-level care when indicated.
Delivery of care in the right place: bolstering community and primary care to reduce inequity in access to care		
4.7	MSK care should be integrated into existing community- or regionally-based service models for non-communicable disease care.	Service models for MSK care should be community- or regionally-based and integrated with existing service models for non-communicable diseases and/or traditional care practices to reduce care disparity due to geography and better support integration of care across different health conditions and providers. Depending on workforce availability, community-led models could be primarily responsible for risk assessment, delivery of community-based interventions and on-referral where more advanced care is needed and not available locally. *"I think it's got to emphasise evidence-based collaborative models where the systems are framed around a multidisciplinary approach. No one discipline has all the answers when it comes to MSK." (ID7)* *"I do strongly believe in a care co-ordinator and maybe you want to call that a musculoskeletal care co-ordinator, that's not a bad idea, but I think musculoskeletal health, probably more than any, maybe diabetes would be similar, but certainly musculoskeletal health has a massive multidisciplinary requirement and we need to have all of those people available not necessarily in the same building, but at least linked somehow to be able to share information, work on the priority needs of the patient in particular and ensure that they are getting what they want where they want it and when they want it in a financially sustainable way. So the patients need to be able to access it without the barriers of cost or location." (ID12)*

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4.8	Community-led service models for MSK healthcare should be co-designed by the community.	Community-led service models for MSK healthcare should be co-designed by the community (inclusive of community and religious leaders) to ensure services are aligned with community needs and are appropriate acceptable, feasible and sustainable. Decentralisation of health delivery to municipalities or communities will also better support integration of services with existing community-based initiatives and resources. *"One of the perhaps ways of overcoming [late referral and late diagnosis] would be to provide primary care clinics in the various regions that are more easily accessible to patients. One of the problems that we find, especially with the specialists in the referral centres, is that the waiting list to get into the clinic is probably three to six months, if not even longer, and in the meantime getting any attention to your underlying medical condition." (ID11)* *"Actually, community engagement and also the decentralisation of health promotion. For example, even if there is a national strategy they can decentralise the authority of the health promotion to each municipality and these municipalities can actually promote health in the community healthcare centres or health services, and then if the older person or citizens can participate in community activities they can get a coupon to use in the community. So this kind of scheme actually exists in Japan, for example, by doing more engagement of communities and then ownership or flexibility or freedom to do what kind of interventions they provide the community. It's a bit adaptive and they respond to the community needs. That actually works." (ID24)*
4.9	Service models should prioritise access to health information and care to vulnerable groups.	Service models need to prioritise access to health information and care to vulnerable groups (e.g. those of lower socioeconomic status, people with intellectual and/or developmental disabilities, people in rural settings, ethnic minority groups) where care disparities are often wider and health outcomes poorer. For example, telehealth services may be useful in overcoming care disparities due to geography. *"So, I think the lower socioeconomic groups, also we often focus on low income countries, but I think also the low socioeconomic segments of developed societies have problems with access to services in many areas." (ID7)* *"In high income countries we definitely see a social gradient, you can say that, where musculoskeletal problems are more frequent the less education you have and the lower income." (ID2)*
Prevention		
4.10	Primary and secondary prevention initiatives for non-communicable diseases should include MSK health	Primary and secondary prevention initiatives for non-communicable diseases (NCDs) should integrate MSK health conditions and pain care, given the shared risk factors (e.g. smoking, inactivity, obesity, poor nutrition) and frequent co- and multi-morbidity between MSK health conditions and other NCDs. *"Obesity is one and tobacco is another that are good for everything else, but also many of our disease patients die from cardiovascular disease, so everything that works on reducing that risk is also very important for our diseases. So I think mainly they are not very special for our rheumatic diseases, but I think those that are common for many other diseases are very important." (ID13)*

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		"Actually, in all global environments it's to do with the general healthcare determinants that are probably less debatable. So, for example, we know that smoking and obesity are risk factors for many musculoskeletal diseases. They're also risk factors for diabetes and heart disease. So a quick win would be to say, "Not only will you be reducing cancer and heart disease, but you're also reducing rheumatic musculoskeletal disease" to the politicians." (ID15)
4.11	MSK-specific primary prevention initiatives should be delivered where evidence of clinical and cost effectiveness exists.	In addition to addressing shared risk factors with other non-communicable diseases, MSK-specific primary prevention initiatives should be included in service models where evidence of clinical and cost effectiveness exists (e.g. osteoporotic fracture prevention). *"…DXA those with a particular score, treat those who have a high ten year risk, reduce fractures. So that screening is there in osteoporosis, that's validated, and that's in the last couple of years." (ID9)*
4.12	National injury (sport, workplace, falls) and trauma prevention strategies and campaigns are needed.	Injury and trauma prevention models are critical for MSK health since most injury and trauma outcomes are MSK-related. Priorities include prevention initiatives for workplace injury, sport injury and trauma from traffic accidents. *"The larger modifiable risk factors when it comes to trauma for the musculoskeletal system, that's much wider. As I said before, it has to do with road, with injury at work, sport prevention. If we look at low- and middle-income countries, it's in particular road accidents that may lead to spinal cord injuries etc. That's especially in the road accidents and that comes up almost at every conference, so that's something that is very important." (ID4)* *"Musculoskeletal trauma is probably <u>the</u> major traumatic event, but when people talk about motor vehicle accidents, they rarely talk musculoskeletal. I mean, clearly, musculoskeletal is where the injury occurs in 90% of the cases, except for head trauma and a few others, but it's usually musculoskeletal and yet you never see motor vehicle accidents under musculoskeletal disease in anybody's categorisation...It's always reported separately. Same way with industrial injuries: 80% of industrial injuries are musculoskeletal, but yet if you look at common statistics it is always separated from musculoskeletal. So, there's a whole series of messages that we can link our message to and make musculoskeletal much more visible and also add to the preventative story. Messages that prevent motor vehicle trauma, industrial injuries, diabetes and many other disorders should be part of that the MSK story. We should not think of MSK disorders as separate from the general health story." (ID10)*

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Category 5: Equitable access to medicines and technologies

Item	Compressed Delphi item (Round 2)	Extended commentary
5.1	Countries need to identify, resource and provide access to essential therapeutics for priority MSK conditions.	There is a need for secure supply chain mechanisms in lower resourced nations to facilitate access to essential therapies for MSK conditions and to enable access to newer, highly effective therapies that control disease activity and improve function. The current COVID-19 pandemic has exposed limitations for MSK healthcare, particularly in low and middle-income countries, including access to care and availability of essential medicines. *"For instance, now patients with lupus have told me that they cannot find hydroxychloroquine, one of the treatments that's used for lupus. I think this came when COVID-19 struck. There was a rush for it and so the patients who are regularly on it cannot access it. If we have a specific fund which is setup for the support of MSK we need not ever run out of something, because at the time even if there is an emergency or there is an epidemic or a pandemic, we will always have that available. We need to have like a guarantee, a provision of access to the medications." (ID3)* *"And many of the drugs, certainly in rheumatology, are desperately expensive. They're very new innovations, the biological therapies, so in terms of research priorities it has to be finding some way for those drugs to be available to the settings where they're going to be needed. But they just can't afford them and whether there's some kind of, well it's not really research, but it's about implementation of new knowledge. Most of these drugs are just not available because they're unaffordable. That might go into your policy making again, I suppose, which is a different priority, but policy making is making these drugs more competitively priced or priced more favourable for low resource settings so more children can access them." (ID6)*
5.2	Global and national prioritisation and management is needed in innovation and access to low cost assistive devices, technologies and interventions that support function.	Research and private partnerships are needed to develop and disseminate low cost assistive devices (living aids) and technologies (e.g. Apps, artificial intelligence, telehealth, surgical innovation such as joint replacement) to improve function and quality of life for people with MSK health conditions or injuries, particularly for use in low resource settings. Coupled with this, there is a need for country-level health technology assessment and management to ensure safety and appropriateness for the local population. *"There are not many low-cost local innovations that you can think of, especially in devices and technologies and assistance gadgets, that would help streamline and improve the affected population's quality of life. So there is a great need for low-cost new ideas that can go in this area. There are a number of examples also that we can identify, such as low cost prostheses for amputees...The current gadgets and devices maybe sometimes have a high price tag but more relevant for high income countries where the systems are set and where the critical infrastructure will allow them to use that effectively. But when you're saying same system, same devices or gadgets working in low income countries without the critical infrastructure etc would not be acceptable. So there's a lot of need for interventions here promoting the technology devices here." (ID19)*

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		"Also, assisted technology is one of the biggest needs that people who have these kinds of problems are experiencing. There are only a few centres in Ethiopia producing different kinds of supportive assistive devices. That's also another area where the musculoskeletal management needs to be improved." (ID30)

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Category 6: Workforce: building workforce capacity, systems and tools

Item	Compressed Delphi item (Round 2)	Extended commentary
Workforce volumes and access		
6.1	Increase the number of medical specialists and allied health practitioners for MSK healthcare in low and middle-income settings.	In many low and middle-income countries (LMICs) there is very limited access to specialist physicians, surgeons and some allied health professionals, due to workforce volumes being low and distributions being largely in cities or urban centres. The limited volume of health professionals and their training positions in LMICs creates care disparity gaps in access to specialist-level care for MSK health conditions. In coming years, the situation is likely to worsen as ageing and retirement of the current medical specialist workforce will further contribute to volume shortages. In addition to responding to current workforce needs, there is a need to engage in future workforce forecasting to inform appropriate capacity-building strategies. *"For example, I came across some WHO or some body's recommendation that a country needs one rheumatologist for 45,000 population, or maybe you can say two rheumatologists for 100,000. But in our country [Bangladesh], there is one rheumatologist for 40 million. And there are many such countries." (ID5)* *"Generally, we have very limited professionals. Like, if you need to see an ophthalmologist, they are few in number. If you need to see a psychiatric doctor, they're few in number. So orthopaedic technologists, physiotherapists, occupational therapists, it's really hard to find those professionals. Even if you find them, you'll find them in the cities, the big cities, they don't want to travel to the deep rural area. Also, there is a huge gap in terms of PT, OT. For example, in Ethiopia there are only two or three occupational therapist facilities to serve more than 100 million people. So, there is a huge gap in the area of managing musculoskeletal conditions." (ID30)*
6.2	Build capacity in the local existing community-based workforce to contribute to basic MSK health and injury care.	Build workforce capacity in low and middle-income countries to address MSK and injury care by leveraging opportunities and building competencies in the existing local, community-based workforce; including traditional and complementary medicine practitioners, volunteers, community health workers, clinicians and other locally-relevant cadres working in other disease or health areas to deliver MSK information/education and care to patients. *"So, a good example might be if you invested in, say, more community workers to do a whole variety of things, vaccinations, clean water etc. but also, they could do something around teaching about road safety, wearing a helmet or seatbelts. They could to that as added value. They can also be taught the bare minimum of how to recognise a child with arthritis. Investing in more community officers, they could do quite a lot of things relatively simply." (ID6)*

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		"… especially you concentrate on low and middle income countries, at the end of the day you also create capacity in the workforce through packages that are for other conditions, you also contribute to create a workforce that can cope and can address musculoskeletal conditions." (ID20)
6.3	Establish flexible service models to enable the non-medical workforce (e.g. nurses, pharmacists, allied health practitioners) to adopt advanced practice/extended scope roles that improve access to evidence-based triage, assessment and management of MSK conditions and injuries.	Establish flexible service models, supported by locally appropriate regulation frameworks, to enable the non-medical workforce (e.g. nurses, pharmacists, allied health practitioners or new workforce cadres such as 'primary musculoskeletal clinicians') to adopt leadership positions through advanced practice/extended scope roles to improve access to evidence-based triage, assessment and management of MSK conditions and injuries, particularly in primary care settings. This strategy may enable more timely access to care and facilitate medical and surgical staff to devote time to where their services are most needed, while building sustainable workforce networks or communities of practice to support training and development. *"We don't have enough healthcare providers so we need to see, can we use other healthcare providers than just physicians, because there is aren't enough physicians. So, for example, for musculoskeletal health and maybe pain also, because you asked me about pain, but particularly for musculoskeletal health, the physiotherapist, chiropractor, osteopath etc. become first line providers." (ID4)* *"So we can educate clinicians but the second thing, and this is what I'd push and I stand out a little bit from the other leaders, I think we have to have a primary musculoskeletal or spine care clinician, somebody other than the family physician and other than the specialist." (ID10)*
Workforce training		
6.4	Integrate MSK health into curricula across medical disciplines and increase the number of MSK medical specialist training positions in low and middle-income countries.	There is a need to expand opportunities for training of medical specialists in MSK medicine in low and middle-income countries and integrate MSK health conditions management in medical training/curriculum more broadly to build capacity across medical disciplines (e.g., general physicians, primary care/family physicians). "*Regarding the model of care, workforce capacity building is the number one issue in our country. We have to develop the curriculum, we have to put MSK conditions in due place into the curricular and also, in our country, we need to increase the number of MSK-related departments and the number of faculty positions; they are also very sparse in our country." (ID5)* *"Many of the areas have a shortage of rheumatologists and therefore departments of medicine that don't have rheumatologists obviously will be teaching less rheumatology, because I think general physicians are uncomfortable with musculoskeletal evaluation. Then, of course, to increase the number of training posts for rheumatologists..." (ID11)*
6.5	Build skills-based competencies across medical, nursing and	Build skills-based competencies across medical, nursing, pharmacy and allied health disciplines (e.g. through professional development programs) and non-clinical roles in low and middle-income countries in primary care/community settings in the identification/screening of MSK health problems (including identification of 'red flags') and best practice basic management

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	allied health disciplines (and non-clinical roles in low and middle-income countries) in the identification of MSK health problems and basic prevention and management practices.	of MSK health conditions and injuries. Such training may require shifting entrenched beliefs and practices about MSK and pain care. Competencies should include early triage and on-referral to more advanced-level care as indicated, supporting effective self-management and delivery of basic, evidence-based education and services (e.g. the advice for managing acute low back pain or other sprains/strains). Workforce competencies could be enhanced through the establishment of clinical networks or virtual communities of practice to support learning in clinical care, cultural competence and health system literacy. *"I think instituting some knowledge or skills or expertise to treat and diagnose. I think if you can impart that at the primary level, that could help prevention a great deal and also could contain the impact of musculoskeletal conditions escalating into major disabilities. So I think there is very much a need here and I think one of the things that we can focus on here are maybe some efforts with costs attached to it, but I think the cost of not doing or not distributing such an idea at the primary level might be humungous." (ID19)* *"We need to improve the education among the non-medical professionals and send the patients who need more advanced care to the physicians and to the specialists . This has shown to be a low-cost model, if you have well trained clinicians in that area, and I think it's worthwhile to try, as long as it's evidence-based." (ID4)*
6.6	Extend training curricula for pre-licensure medical, nursing, pharmacy and allied health clinicians in MSK health, persistent pain and injury care within a biopsychosocial model.	Extend training curricula for pre-licensure medical, nursing, pharmacy and allied health clinicians in MSK health, persistent pain and injury care within a biopsychosocial model that emphasises interdisciplinary care. In particular, there is a need for enhanced curriculum for medical students and other health professional students to support delivery of the right, evidence-based care for MSK health and for all disciplines in best-practice care for persistent pain (e.g. aligned with the International Association for the Study of Pain curriculum recommendations). *"The goal should be to develop an educational program to healthcare professionals. Healthcare professionals are not well-trained to manage chronic pain. This goal aims to cover this lack in professional formation, avoiding common problems such as overdiagnosis, under- and overtreatment. For example, here in Brazil we have more than 800 physical therapy courses. I think that now it's more than 1,000 physical therapy courses around the country. We performed a study in 2017 to see if the PT schools have a specific curriculum for pain and we investigated almost 400 schools and only 6% or 7% have a specific course for pain. The curriculum is not adequate, like the recommendation of IASP for physical therapies and occupational therapies. So, when some schools have the curriculum for pain they are not fully covered. I think that the training of undergraduates is an important issue that should be planned how can we cover this lack of information for all the professions, like doctors, physical therapists, occupational therapists, psychologists?" (ID28).* *"In most of the medical schools, I think, all over the world you don't have any education on musculoskeletal disease. You have one week of orthopaedics. I think rheumatology probably a couple of days in all the medical education. Then when they are facing the outpatient clinics, probably around 25% of the patients they are seeing have musculoskeletal complaints and they have not been trained . Then I think that primary care training is also more or less the same, at least in many countries I know. So, there is very little training in*

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		musculoskeletal disease, recognising the disease and early derivation and early diagnosis. So, I think there is a lot that needs to be done there." (ID13)
6.7	Educate healthcare workers and health planners to deliver information and care aligned to positive health behaviours for MSK health and other non-communicable diseases.	There is a need for educating and supporting healthcare, public health and health administration/planning workers to deliver information and care aligned to positive health behaviours in order to reduce modifiable risk factors for MSK health conditions and other non-communicable diseases (NCDs). This includes supporting healthily life choices (e.g. nutrition, activity) and health literacy. A greater emphasis from the health workforce on primary and secondary prevention may serve to better support public health initiatives targeting risk reduction for NCDs. In this context, workforce capacity could be enhanced through the establishment of clinical networks or virtual communities of practice. "I'm also thinking around the area of workforce capacity building. I think that's an area, especially in primary care, where people would probably struggle, so when you propose okay, can you improve the capacity of our healthcare workers to recognise and manage musculoskeletal conditions, how do you do that in such a way that they will also be equally strengthened not just for musculoskeletal pain, but maybe overall NCD management and empowering patients to take on a more active lifestyle, to be more conscious about how their bodies are feeling, to seek a consultation right away, so improving health-seeking behaviour, improving health literacy." (ID27)
Remuneration		
6.8	Increase remuneration for the health workforce in low and middle-income countries to maintain workforce volumes.	There is a need to increase remuneration for health workers who manage people with MSK conditions in low and middle-income countries in order to retain the workforce and attract trainees. *"Also, I mentioned that the average annual income in the survey of rheumatology we did was $2,000 USD per month. So, it's very low and probably is lower than many of the other specialists, so I think something the government can do is pay better the physicians involved in musculoskeletal conditions. So, I think something that, again, we do not fight for it, but I think it's important." (ID13)*

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Category 7: Surveillance: monitoring population health

Item	Compressed Delphi item (Round 2)	Extended commentary
7.1	Build country-level population health surveillance capacity to monitor incidence, prevalence and impact of MSK conditions.	There is a need to develop national capacity in surveillance of population health states that includes MSK health conditions, pain and injuries. MSK health surveillance should be integrated with existing national health surveillance systems, rather than promoting the establishment of stand-alone monitoring. Integration with existing surveillance systems and metrics is important to ensure a comprehensive understanding of population health and relative burden of disease. In some contexts, integration of data may require data linkage systems. Surveillance capacity requires infrastructure and systems for accurate population health assessments (e.g. population health surveys; occupational injury systems; road traffic injury systems). In particular, there is a need to measure national-level outcomes of incidence, prevalence and system impact (e.g. cost and health service utilisation) over time. Local surveillance data inclusive of prevalence, cost and morbidity are critical to inform appropriate national-level responses to local burden of disease estimates, support local advocacy efforts and contribute to global burden of disease research. *"I think one of the reasons that this is not a priority at the moment could be that some of these nations will not have established data. The numbers are not known and so the disease burden is not really understood and therefore one of the ways that this could be directed is to start collecting data and use it. Maybe also this would require going into communities to find maybe is this happening in particular places and much more than other places. So, the first step could be just having that establishment of some credible information so that we know what numbers we are dealing with." (ID3)* *"So musculoskeletal prevention is very broad. It has to be based on the injury and epidemiology of the country, the injury statistics and the epidemiology of the country to be effective. You can't take a strategy from one country and just implement it in another country. You have to understand what are the injuries and how can they be prevented in that community." (ID4)* *"It's crucial and I think it's missing in the infrastructure of most of these low and middle-income countries. I think tracking the incidence of illness, looking at things like hospitalisations, length of stay, all these sorts of things, costs of medications, all the things that can be tracked in First World countries are what allow us to budget appropriately for healthcare delivery. If they're not able to do that, if they don't have that infrastructure, then that's why healthcare is generally underfunded in these countries, I think, because there's no concept of what the actual cost of healthcare is." (ID26)*
7.2	National health surveillance metrics need to include measurement of	Surveillance metrics needs to extend beyond disease and injury measurement (prevalence, incidence) and cost (service utilisation) to also monitor disease impacts (function, participation, satisfaction and quality of life; i.e. Patient Reported Outcome Measures [PROMS]) and availability, access and satisfaction (i.e. Patient Reported Experience Measures [PREMS]) with care in order to inform policy and resourcing decisions at national and sub-national levels. For adults, this may include

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	function, participation, quality of life and care experience.	participation in work, while for children it may include participation in school. The wide-scale use of digital devices and wearables in many countries may enable rapid and scalable measurement of population health states and health behaviours in the future. *"The problem with a pure numbers game is it always does children a disservice because the numbers of children affected with MSK problems is so much less than adults. So, some kind of metric that takes in the impact, so maybe it's number of days off school or something like that, or educational attainment. That's very indirect, but if you had a diagnostic code against a metric that looked at impact, so not being able to go to school, not being able to go to higher education, not getting a job." (ID6)* *"In terms of innovation, now with the available devices, we can use the available devices for how many steps we can walk and what kind of physical exercise we're doing. Even though there is an issue of the user information privacy thing, it would be fantastic if we could use anonymous data to monitor physical activity." (ID24)*
7.3	Surveillance outcomes should be disaggregated by age, sex and gender, geography, socioeconomic status and by the International Classification of Disease (ICD) and International Classification of Functioning, Disability and Health (ICF) systems.	National health surveillance capability should include capacity for disaggregation of data by narrow age bands, sex and gender, geography, socioeconomic status and International Classification of Disease (ICD) and International Classification of Functioning, Disability and Health (ICF) systems. Such disaggregation and systems for reporting are needed to determine local priorities by population group(s) and monitor responses across the life-course and broad range of musculoskeletal conditions in real-time (cross-sectionally) and over time (retrospectively and prospectively). *"But the other thing most important, and if there's only one thing that is documented today, is we do not collect data that's disaggregated by age. So 65, that's about it. If we're lucky, 75. …but disaggregated data is going to be critically important and also the associations between the NCD groups, age, socioeconomic status will actually give us that granular illustration of what's going on." (ID23)*

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Category 8: Research and innovation

Item	Compressed Delphi item (Round 2)	Extended commentary
Priority fields of research		
8.1	**Epidemiologic and population health research**: lifecourse risk factors; risk assessment tools; core outcomes for population health research.	Research is needed to identify evidence for: • modifiable and non-modifiable risk factors for MSK health conditions across the lifecourse and by sex and gender; • the development of tools to simply identify risk of MSK conditions for use in clinical care and by the public; • a core set of outcome measures or indices for MSK health that can be used across countries in prospective population health research. *"What we haven't been able to achieve in that time is a population understanding of what are the risks and what are the potential prevention measures that we can undertake to improve the situation because, unfortunately, with the ageing population and the increasing population overall, it's getting worse. There are more people with these conditions and we are going backwards with our ability to control the consequences of what most of us actually endure because of our own actions, our own lack of understanding." (ID12)* *"I think what we need to do - and this is not a small task - is to come up with an agreed core set of measures that are fit for purpose so they can be deployed in largescale surveys, they are translatable into other languages and settings, and which are sensitive to change over time. So I think that is going to be the thing that we need to do, because then the earlier point we were discussing before about the power of having policymakers and health departments and taking their own data to them I have found professionally to be extremely powerful." (ID21)*
8.2	**Public health research**: public health interventions to shift health behaviours; impact of MSK health on other conditions; dynamic systems modelling to inform public health policy.	Public health research is needed to: • examine health behaviour change strategies targeted modifiable risk factors and how MSK health impairments or injuries impact on health outcomes for other non-communicable diseases is needed; • evaluate prevention initiatives for priority conditions, such as MSK pain, through public health interventions and dynamic systems modelling. Such evidence is needed to inform policy decisions for prevention of MSK health conditions. *"but I do think there is important work to be done to show how musculoskeletal health underpins progress on other NCDs as well. Because if it's affecting your ability to be functional, in particular your physical function and your wellbeing, then you are unlikely to be able to undertake the sorts of self-management activities that are going to also help you with other chronic conditions as well." (ID21)*

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		"So, for example, there's a lot of interesting work going on in dynamic systems modelling which is used in prevention and helping policymakers develop prevention-focused policies. It's been a long time since we've had real thought leadership in the prevention space from a theoretical perspective and I think things have really changed in the last five years and it's a good opportunity for us to engage with those developments and see how they can do." (ID21)
8.3	**Health policy and systems research**: implementation of MSK service models across contexts; strategies to reduce health inequalities and access inequities; development of MSK health classification system; effectiveness and acceptability of digital technologies to support MSK care and surveillance.	Priorities for health policy and systems research include: • National-level implementation research on acceptable and (cost)-effective service and financing models, including innovative pilot programs, to support delivery of the right MSK care in primary and secondary care settings is needed. Such evidence likely needs to be collated from research using designs other than randomised controlled trials (e.g. mixed-methods research) with a focus on examining implementation feasibility and acceptability to people in different settings and in the context of other health priorities, local healthcare practices and integration with existing service models. For example, intrinsic capacity varies widely among older people, so service models that aim to increase functional ability need to consider such variability. • Research that examines how health systems can be influenced to support reductions in inequalities in health outcomes and inequities in access to MSK healthcare and how positive health behaviour change can be supported at the population level is needed. • Research is needed that supports the development and evaluation (acceptability and utility) of classification systems for MSK health conditions for use by health systems. • Health services research is needed to evaluate the effectiveness and acceptability of digital technologies in improving access to care and scalable surveillance of health behaviours. *"I think there now must be a focus on implementation research when it comes to MSK. I think the past decade in particular has repeatedly demonstrated what's effective and what's not, so we know what works and what doesn't. The Lancet when it comes to low back pain, I think the other work in relation to MSK disorders, I think we have a far greater understanding of what is effective and what isn't. But I think that when it comes to MSK conditions what we need to do is look at investigating the effects of introducing dedicated MSK services into primary and secondary care. That may require a different research design than we've previously seen with RCTs, because we know that when it comes to MSK the range of interventions and being able to narrow the effectiveness of any one particular intervention is sometimes quite a challenge." (ID7)* *"We've consistently gone down the route of RCTs, which are really not very helpful. We know they're not helpful. They don't really bring a lot to that individual. You're just squeezing something very small out of it and actually it's not helpful. So we need to shift to more qualitative studies probably and more mixed methods which are much more appropriate, and maybe try and use some live data that we can get hold of." (ID17)*

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		"…patient reported outcome measures have been shown to be particularly effectively used in Scandinavia in recent years because of the use of smartphone apps. Patients have been tracked with smartphones and it seems that the response is far more rapid and there's a greater level of response if you're communicating with someone on a smartphone." (ID7)
8.4	**Clinical and basic science research**: mechanisms associated with MSK conditions, including persistent pain; curative therapies for MSK conditions; biomarkers, assays and diagnostic applications; and extend evidence for non-surgical and non-pharmacologic interventions.	Basic science research should continue to pursue (i) improve the understanding of mechanisms associated with MSK conditions, including persistent pain (ii) curative therapies for MSK health conditions (supported by registries to monitor safety and effectiveness), and (iii) the exploration of new biomarkers for MSK diseases, assays and early diagnostic applications. In clinical research, there is a need to maintain and extend evidence for non-surgical and non-pharmacologic interventions for various MSK health condition. Such evidence is needed to inform clinical care and inform and health systems in service design and funding. *"You mentioned innovation earlier, you talked about developing in the context of innovation and I could talk about biomarkers, assays, early diagnostic kits, prognostic ways of looking at progression of disease." (ID31)* *"We still don't know exactly what really works for different conditions, like which is the ideal physical exercise or particular exercise and which can be the physical agents that I can use when? For example, I have osteoarthritis of the knee. Is it simply ice for 20 minutes or would you recommend to add something else? So I think this would be really important because we could provide low and middle-income countries, which are those that probably have the least culture about this, because they are now getting older so they are getting acquainted with all these issues at the moment." (ID29)*
8.5	**Health economics**: cost of MSK health conditions and injuries to communities and governments; cost effectiveness of treatments; cost effectiveness of integrating MSK health prevention and management within broader non-communicable disease care; and return on	Key priorities for health economics research include: • Broad health economics research is needed to produce robust evidence concerning the scope and size of the cost burden of MSK health impairment to governments and the cost of the counterfactual argument of not taking any action. • Focussed health economics research is needed to produce evidence on the cost-effectiveness and system-level efficiencies achievable from integrating MSK healthcare with other health service models (e.g. non-communicable disease care). • Focussed health economics research is needed to produce evidence on the cost-effectiveness of new therapies for MSK conditions, using metrics such as Quality Adjusted Life Years (QALYs). • Health economics research is needed that shows return on investment for acting on MSK health impairment prevention and management to sectors outside of health, e.g. workforce and schooling participation, unemployment benefits, disability payments, long-term care services for older adults.

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	MSK health investment for other sectors such as workforce participation.	*"We needed to take a different tack, so what we did is we said, "Alright, we don't die. Because of that, we live and because we live for a very long period of time, we are costing you a fortune". So we got all the health economists on board that we could and we did a thorough data analysis around what that cost actually was. In the end we got what we wanted, we got national health priority status, and it was all about showing them the cost of not doing anything. So, the argument was spend a little/save a lot." (ID12)* *"The case still needs to be made because one of the things and really the point that will create momentum in the musculoskeletal conditions is the issue of cost and seeing that now in high income countries musculoskeletal conditions are the biggest driver of cost. So, the argument that needs to be built and the evidence that needs to be built is whether integration will also contribute to reducing the cost of care, having the same quality outcomes." (ID20)* *"Research, if I look at it from a systems' perspective, it's really trying to get more tangible numbers around it. So usually these are economic studies and contextual studies, especially if you're talking about sectors, so what does this mean maybe around working young adults and the elderly or young children who are already struggling?" (ID27)*
Capacity building in MSK research		
8.6	**Capacity priority 1**: support national-level MSK health research; multi-national and interdisciplinary research collaborations; and lower-resourced settings undertaking critical local research.	There is a need to increase capacity in MSK health research globally through supporting national-level MSK health research, supporting multi-national research collaborations and supporting lower-resourced settings to undertake critical local research and participate in international research (e.g. though postdoctoral fellowships). At a national level, countries with sufficient resourcing may consider establishment of dedicated MSK health research institutes to address national priorities/knowledge gaps in MSK healthcare, to support cross-discipline collaboration, and to drive research translation and dissemination. *"I think it's probably having research that's done that represents the spectrum of settings and also about the capacity-building. You've got to involve local researchers. That might be part of multinational collaborations. I mean, these days with IT you can connect with somebody anywhere in the world, so the idea of mentoring and supporting a local PI to develop an idea for a clinical trial in X versus X. You've got to have that kind of capacity-building locally and some mechanisms are shared data." (ID6)*
8.7	**Capacity priority 2:** Support co-design of research by people with lived experience of various MSK health conditions and clinicians.	Greater prioritisation for partnering with patient groups and clinicians is needed from the inception of research initiatives in order to identify research priorities and outcomes that are meaningful to local population groups. These partnerships are also critical to supporting dissemination and driving strategic directions for national MSK health research. This is particularly important for vulnerable and minority groups where care disparities are often wider. *"So I think that research agendas would look much different if patient partners were included in that process and throughout the spectrum, from the research agenda including patient partners all along the spectrum of the research process, from the decision of what question is going to be asked to the dissemination of the information at the end of it, which I think would help so much with knowledge translation or knowledge getting out into the public sphere and getting into clinics faster, because then it can have a more plain language feel, a more real world thing." (ID8)*

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Funding for musculoskeletal health research		
8.8	Increase the proportion of research funding allocated to MSK research and allocate additional funding leveraged through public-private partnerships.	A greater proportion of research funding (from any source) needs to be directed to MSK research commensurate with the burden of disease, while specific additional research funding for MSK health research may be facilitated through public-private partnerships. Countries should identify national health priority areas aligned to burden of disease and target research investment with these priority areas. There is also a need to increase research funding for primary research in MSK health and also to drive dissemination and translation of research outcomes to inform clinical care, public knowledge and behaviours and health system reform initiatives. *"If the government does not think MSK conditions are important, they do not pay much money to research. In Japan also the public research fund is mainly going to the management of cancer or cardiovascular diseases because we are not one of the five important diseases." (ID1)* *"I've been working a lot with providing funding for research because that's really the first obstacle. If you compare research funding to the global burden, it's very disproportionate with respect to musculoskeletal problems, so we need to prioritise funding of musculoskeletal research as such." (ID2)*
Innovation and evidence translation		
8.9	Support innovation sharing between countries and between researchers and clinicians.	Establishing pathways and systems that allow countries to facilitate sharing of interventions or system innovations for MSK health are needed. This is particularly important to share innovation between high-income and low and middle-income countries to mitigate gaps access to research innovations. *"I think where countries are doing something that's good and it works, having some systems or a facilitative process that allows that to be shared. I know we've got the EU work that we do on a whole range of areas, but how could that happen on a larger and a wider scale in a more systematic way?" (ID17)* *"Lastly, facilitate the communication between pain researchers and specialists and clinicians. I think there is a big gap between what we produce in research and also what we have in clinical practice and we need to think about different ways to decrease this gap." (ID28)*
8.10	Support research that harnesses the emerging potential of digital technologies and the collection and	Research and innovation that harnesses the emerging potential of digital technologies and the collection and use of 'big data' and machine learning are important for exploring prevention and management opportunities for MSK health conditions and MSK pain (e.g. personalised medicine, identification of personalised risk factors). *"I believe that we need to improve our capacity to predict the development of chronic pain. In the future, for example, it is possible that machine learning algorithms will help clinicians and patients to identify the risk to develop chronic musculoskeletal pain conditions. These*

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	use of 'big data' and machine learning.	*algorithms with specific variables could be available for population, collecting information about exercise routine, stress level, mental health and others. The algorithm should be able to identify who are at risk to develop chronic musculoskeletal pain and send them some recommendations and also suggest to look for a health service. So if you can do that, for me, it's perfect for prevention and also perfect for population." (ID28)*

SUPPLEMENTARY FILE 14

Policy scoping review summary tables

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Policy scoping review document inclusion/exclusion outcomes

Entered into pool	**N documents**	
Desktop internet search	123	
Study team and expert networks	11	
Snowballing	12	
Delphi respondents	19	
Total documents collected	**165**	
Exclusions	**Number excluded**	**Countries**
Duplicates	6	
Older than 2010/superseded versions	7	EU, France, Norway
No substantial MSK component	10	Bangladesh, Canada, Columbia, Denmark, Ireland, Mexico, Pakistan, Turkey
Non-government report on burden of disease and risk factors	4	EU, Norway, United Kingdom
Government report on burden of disease and risk factors	14	Canada, Ethiopia, EU, France, Germany, Iran, Mexico, Norway, Philippines, Thailand
Non-government issued clinical and treatment guidelines	25	Brazil, Canada, Columbia, EU, Germany, International, Malaysia, Norway, Philippines, USA, UK,
Government issued clinical and treatment guidelines	31	Australia, Austria, Belgium, Canada, China, Denmark, France, Germany, Italy, Malaysia, South Africa, Sweden, UK, USA
Non-government "Calls to Action" or action plans	13	Chile, Brasil, EU, International, Spain, UK
Other 'not policy' (consumer information, evaluations, clinical research, medical education, templates)	14	Australia, international, France, England, Wales, European Union, China, Norway, Italy, Canada, Netherlands
Total excluded	**124**	
Total remaining for analysis	**41**	**Australia, Belgium, Canada, Chile, Columbia, Denmark, Finland, France, Hungary, Italy, Ireland, New Zealand, Norway, Portugal, Republic of Korea, Spain, Switzerland, Turkey, United Kingdom (England), United Kingdom (Scotland), United Kingdom (Wales), USA; and two multi-national regions (European Union, international)**

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Characteristics of included policy documents

Document #; country	Title (Publisher)	Year published (Years Operational)
Australia 1	Australian National Strategic Action Plan on Arthritis (Australian Government, Department of Health)	2019
Australia 2	Australian National Strategic Action Plan on Osteoporosis (Australian Government, Department of Health lth)	2019
Australia 3	Australian National Strategic Action Plan for Pain Management (Australian Government, Department of Health)	2019
Belgium 1	Aanpak van chronische pijn in Belgie: Verleden, heden en toekomst (Management of chronic pain in Belgium: past, present and future) (Federal Public Agency for Public Health, Safety, Food and the Environment, Belgium)	2011
Canada 1	Institute of Musculoskeletal Health and Arthritis Strategic Plan 2014-2018: Enhancing Musculoskeletal, Skin and Oral Health (Canadian Institute of Health Research)	2014 (2014-2018)
Canada 2	Joint Action on Arthritis - a framework to improve arthritis prevention and care in Canada (Arthritis Alliance of Canada)	2012
Canada 3	Chronic Pain in Canada: Laying a Foundation for Action (Health Canada)	2019
Chile 1	Estrategia Nacional De Salud Para el cumplimiento de los Objetivos Sanitarios de la Década 2011-2020 (National Health Strategy to complete the Health Objectives of the Decade) (Government of Chile)	2011 (2011-2020)
Columbia 1	Plan Nacional de Seguridad y Salud en el Trabajo 2013 – 2021 (National Plan for Safety and Health at Work 2013 – 2021) (Ministry of Labor, Columbia)	2014 (2013-2021)
Denmark 1	Anbefalinger for tværsektorielle forløb for mennesker med kroniske lænderygsmerter (Recommendations for multidisciplinary management of low back pain) (National Health Board of Denmark)	2017
European Union 1	European action towards better musculoskeletal health (EFORT/EULAR/IOR)	2017
European Union 2	Occupational health and safety risks in the healthcare sector-Guide to prevention and good practice (European Commission)	2010
Finland 1	Kroonisen kivun ja syöpäkivun hoidon kansallinen toimintasuunnitelma vuosille 2017–2020 (National Action Plan for the Treatment of Chronic Pain and Cancer Pain) (Ministry of Social Affairs and Health, Finland)	2017
France 1	Plan d'amélioration de la prise en charge de la douleur, 2006 – 2010 (Monitoring Plan for National Pain Program) (Ministry of Health and Solidarity, France)	2006 (2006-2010)
France 2	Plan santé au travail, 2016-2020 (Occupational Health Plan 2016-2020) (Ministry of Labour, France)	2016 (2016-2020)
Hungary 1	Egészséges Magyarország 2014-2020 (Health Hungary 2014-2020- Health Sector Strategy) (Ministry of Human Resources, State Secretariat for Health, Government of Hungary)	2015

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International 1	A framework to evaluate musculoskeletal models of care (Global Alliance for Musculoskeletal Health of the Bone and Joint Decade)	2016
Italy 1	Piano Nazionale della Cronicità (National Plan for Chronic Disease) (Directorate-General of Health Programming, Italy)	2016
Ireland 1	The Model of care for Rheumatology in Ireland (Royal College of Physicians of Ireland)	2015
New Zealand 1	National Health Committee Low Back Pain: A Pathway to Prioritisation (National Health Committee, New Zealand)	2014
New Zealand 2	Low Back Pain (LBP) Tier 2 Assessment (National Health Committee, New Zealand)	2015
New Zealand 3	The Mobility Action Program (New Zealand Ministry of Health)	2015
Norway 1	Norway: Together for a good working environment (European Agency for Safety and Health at Work, Norway)	2007-2010
Norway 2	Folkehelsemeldinga 2018-2019: Gode liv i eit trygt samfunn (Public Health Report 2018-2019: Good Life in a Safe Society). (Norwegian Ministry of Health and Care Services, Government of Norway).	2018 (2018-2019)
Portugal 1	Plano Estrategico Nacional De Prevencao E Controlo Da Dor (PENPCDor) (National Strategic Plan for Pain Prevention and Control (PENPCDor)) (Directorate General Health, Portugal)	2017
Republic of Korea 1	제3차 국민건강증진종합계획 (2011~2020) (The 3rd National Health Promotion Plan 2011-2020) (Korean Ministry of Health and Welfare)	2011
Spain 1	Estrategiade Atenciónal Dolor 2017-2020 (Pain Care Strategy 2017-2020) (City of Madrid, Spain)	2017 (2017-2020)
Switzerland 1	Nationalen Strategie Prävention nichtübertragbarer Krankheiten (NCD-Strategie) 2017 – 2024 (National strategy for the prevention of noncommunicable diseases 2017-2024) (Federal Office of Public Health and Swiss Conference of Cantonal Health Directors, Bern, Switzerland).	2016 (2017-2024)
Switzerland 2	Nationale Strategie Muskuloskelettale Erkrankungen (2017-2022) (National Strategy for Musculoskeletal Disorders 2017-2022) (Rheumaliga Schweiz, Switzerland)	2017 (2017-2022)
Turkey 1	Türkiye Kas ve İskelet Sistemi Hastalıkları Önleme ve Kontrol Program (2015-2020) (Turkey Musculoskeletal Disease Prevention and Control Program 2015 - 2020) (Ministry of Health, Turkey)	2015 (2015-2020)
United Kingdom (England) 1	Developing partnerships and a whole-system approach for the prevention of musculoskeletal conditions in England (Public Health England)	2018
United Kingdom (England) 2	Musculoskeletal core capabilities framework for the first point of contact practitioners (Health Education England and NHS England)	2018
United Kingdom (England) 3	Musculoskeletal health: A 5-year strategic framework for prevention across the life course (Department of Health and Social care, Public Health England and Department for Work and Pensions)	2019 (2019-2023)
United Kingdom (Scotland) 1	Allied Health Professional (AHP) Musculoskeletal Pathway framework (National Minimum Standard) (The Scottish Government)	2014

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United Kingdom (Scotland) 2	Future Provision of Specialist Residential Chronic Pain Management Services in Scotland: Consultation Report (Scottish Government)	2014
United Kingdom (Wales) 1	Living with Persistent Pain in Wales (Welsh Government)	2019
United States of America 1	Improving pain management and support for workers with musculoskeletal disorders: Policies to Prevent Work Disability and Job Loss (US Department of Labor/IMPAQ International, USA)	2017
United States of America 2	National Institute for Occupational Safety and Health (NIOSH) Musculoskeletal Health Program (National Institute for Occupational Safety and Health, USA)	2019
United States of America 3	A National Public Health Agenda for Osteoarthritis: 2020 Update (Osteoarthritis Action Alliance, Centre for Disease Control and Prevention, Arthritis Foundation, USA)	2020
United States of America 4	National Pain Strategy: A Comprehensive Population Health-Level Strategy for Pain (Department of Health and Human Services / Interagency Pain Research Coordinating Committee, USA)	2011
United States of America 5	Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research. (Institute of Medicine, USA)	2011

SUPPLEMENTARY FILE 15

Content themes scoping review

Supplementary file 15

Themes and subthemes inductively derived from MSK policy documents

Theme	Sub-themes
Service Delivery	Theme 1 – Person centred care
	Theme 2 – Identifying and supporting vulnerable and priority populations
	Theme 3 - Lifestyle interventions, prevention, early intervention
	Theme 4 - Interdisciplinary and integrated services
	Theme 5 - Evidence-based care
	Theme 6 - Access to specialist and rehabilitation services
	Theme 7 - Risk screening and prioritisation
	Theme 8 - Service mapping
	Theme 9 - Quality of care
Workforce	Theme 1 - Workforce networks
	Theme 2 - Resources for use in practice
	Theme 3 - Continuous education
	Theme 4 - Support tools and systems
	Theme 5 - Workforce qualities
	Theme 6 - Undergraduate and post-graduate education
	Theme 7 - Workforce planning
	Theme 8 - Administrative workforce
Medicines and technologies	Theme 1: Pharmacological and biologic intervention
	Theme 2: Technologies for service delivery
	Theme 3: Place of medicine multi-disciplinary care
	Theme 4: Medicine education and knowledge for citizens
	Theme 5: Bio-mechanical interventions / living aids
	Theme 6: Use of opioids
Financing	Theme 1: MSK targeting funding
	Theme 2: Funding beyond clinical services
	Theme 3: Incentives for coordination, multi-disciplinary and whole-of-person
	Theme 4: Budget allocation in line with burden
	Theme 5: International financing mechanisms
	Theme 6: Affordable services
Data and information systems	Theme 1: Determining quality indicators
	Theme 2: Mainstreaming monitoring and evaluation
	Theme 3: Data systems infrastructure
	Theme 4: Data reporting, dissemination and use
	Theme 5: Linking local data sources
Leadership and governance	Theme 1: Championing MSK health
	Theme 2: Establishing systems for decision making
	Theme 3: Delegating leadership
	Theme 4: Data for leadership
	Theme 5: Building local capacity and leadership

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Citizens, consumers and communities	Theme 1: Public education and awareness
	Theme 2: Working in partnership
	Theme 3: Identifying and supporting vulnerable and priority populations (Cross-over service delivery Theme 2)
	Theme 4: Citizen science and data
Research and innovation	Theme 1: Investment in research
	Theme 2: Research dissemination, translation, and implementation
	Theme 3: The research and innovation workforce
	Theme 4: Research policy and funding systems

SUPPLEMENTARY FILE 16

Supplementary file 16

Organisations represented in Round 1 of the eDelphi, n=116

1. Academic Consortium for Integrative Medicine and Health, USA
2. African League of Associations of Rheumatology
3. Afyafrica Orthopedic Services, Kenya
4. Al-Aleem Medical College; Rheumatology Faculty University of Health Sciences (UHS), Pakistan
5. American Academy of Orthopaedic Manual Physical Therapists
6. American Association of Nurse Practitioners
7. American Bone Health
8. American Chronic Pain Association
9. American College of Rheumatology
10. American Physical Therapy Association
11. American Society for Bone and Mineral Research
12. Ankylosing Spondylitis Association South Africa
13. Arthritis & Osteoporosis Western Australia
14. Arthritis and Musculoskeletal Alliance UK
15. Arthritis Care Foundation, Pakistan
16. Associazione Italiana per lo Studio del Dolore (Italian Association for the Study of Pain)
17. Associazione Malati Reumatici del Piemonte (Rheumatic Patients Association of Piedmont)
18. Associazione Nazionale Malati Reumatici - Anmar Onlus (Italian National Association of Rheumatic Diseases)
19. Australia and New Zealand Musculoskeletal Clinical Trials Network
20. Belgian Chiropractic Union
21. British Chiropractic Association
22. Canadian Chiropractic Association
23. Care & Public Health Institute, University Maastricht. Netherlands
24. China Disabled Persons' Federation
25. Chiropractic Association of South Africa
26. College of Podiatry UK
27. Cyprus League Against Rheumatism
28. De Nationale Vereniging ReumaZorg Nederland (National Association of Reuma Care Netherlands)
29. Defence Forces Physiotherapy Ireland
30. Deutsche Rheuma-Liga
31. Deutschen Gesellschaft für Orthopädie und Orthopädische Chirurgie (DGOOC) (German Society for Orthopedics and Orthopaedic Surgery)
32. Deutschen Gesellschaft für Unfallchirurgie (DGU) (German Society for Trauma Surgery)
33. European Academy of Chiropractic
34. European Alliance of Associations for Rheumatology - People with Arthritis and Rheumatism
35. European Chiropractors' Union
36. European Federation of National Associations of Orthopaedics and Traumatology

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37. European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases
38. Fatima Jinnah Medical University (FJMU), Pakistan
39. Global Fragility Fracture Network
40. Hellenic League Against Rheumatism
41. Humanity & Inclusion
42. Hungarian Chiropractors' Association
43. Institute for the Study and Treatment of Pain
44. Institute of Physical Art
45. International Association for the Study of Pain Global Alliance of Pain Patient Advocates Presidential Task Force
46. International Association for the Study of Pain (Musculoskeletal Pain Special Interest Group; Pain, Mind and Movement Special Interest Group)
47. International Federation of Podiatrists
48. International Maitland Teachers Association
49. International Osteoporosis Foundation
50. International Pediatric Association
51. International Society of Physical and Rehabilitation Medicine
52. IPA Manhattan - Physical Therapy, USA
53. Japanese Association of Chiropractors
54. Japanese Society of Chiropractic Science
55. Johnson and Johnson Physical Therapy
56. Journal of Joint Diseases and Related Surgery
57. Juvenile Arthritis Research
58. Kenyan Society of Physiotherapists
59. Lee Kong Chian Medical School, Nanyang Technological University, Singapore
60. Lupus Foundation of Bangladesh
61. Maastricht University Medical Center, Netherlands
62. Malaysian Allied Health Profession Council
63. Malaysian Physiotherapy Association
64. Medical Rehabilitation Therapists (registration) Board of Nigeria
65. MiracleFeet
66. Mongolian Physical Therapy Association
67. Mongolian Society of Physical and Rehabilitation Medicine
68. Musculoskeletal Australia
69. National Hospital & Medical Center (NH&MC), Pakistan
70. National University of Mongolia, Department of Physiotherapy
71. NCD Alliance
72. NCD Child
73. Netherlands Chiropractors Association
74. Norwegian Association for Women with Pelvic Girdle Pain
75. Norwegian Chiropractors´ Association
76. Norwegian Council for Musculoskeletal Health
77. Norwegian Interdisciplinary Organisation in Rheumatology
78. Osteoarthritis International Foundation
79. Osteoarthritis Research Society International

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80. Paediatric Global Musculoskeletal Taskforce (Global Alliance for Musculoskeletal Health)
81. Pain Center of Hospital das Clinicas of University of Sao Paulo School of Medicine
82. Pain Relief and Physical Therapy
83. Pain Relief and Physical Therapy Orthopedic Physical Therapy Residency, USA
84. Pain Society of the Philippines
85. Pan Arab Osteoporosis Society (PAOS)
86. Pan-American League of Associations for Rheumatology
87. Peking University People's Hospital
88. Philipps-Universität Marburg Germany,
89. Programa Municipal de Espalda Saludable (Healthy Back Programme of City Council)
90. Public Health England
91. Rehabilitation International
92. Rheumatology for All
93. Russian Association on Osteoporosis
94. Seminars in Arthritis and Rheumatism (scholarly journal)
95. Sociedad Argentina de Reumatología (Argentinian Society for Rheumatology)
96. Société Internationale de Chirurgie Orthopédique et de Traumatologie (International Society of Orthopaedic Surgery and Traumatology)
97. Spanish Pain Society
98. Syrian National Osteoporosis Society
99. Tan Tock Seng Hospital, Singapore
100. The Center for the Study of Pain of Mongolia
101. The Japanese Society for Bone and Mineral Research
102. The Karen Hospital, Kenya
103. Turkish Chiropractic Association
104. Turkish Joint Diseases Foundation
105. Tzeadim-Israeli Association for Joint Disease and Joint Implanted People
106. Universidad del Norte, Columbia
107. Universiti Teknologi MARA Shah Alam, Malaysia
108. University College of Osteopathy, UK
109. University of Pittsburgh, USA
110. US Pain Foundation
111. Vision Community Based Rehabilitation Association, Ethiopia
112. World Federation of Chiropractic
113. World Federation of Occupational Therapists
114. World Health Organization (WHO)
115. World Physiotherapy (including International Federation of Orthopaedic Manipulative Physical Therapists subgroup)
116. World Spine Care