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Health systems strengthening to arrest the global disability burden: empirical development of prioritised components for a global strategy for improving musculoskeletal health

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ABSTRACT

Introduction Despite the profound burden of disease, a strategic global response to optimise musculoskeletal (MSK) health and guide national-level health systems strengthening priorities remains absent. Auspiced by the Global Alliance for Musculoskeletal Health (G-MUSC), we aimed to empirically derive requisite priorities and components of a strategic response to guide global and national-level action on MSK health.

Methods Design: mixed-methods, three-phase design.
Phase 1: qualitative study with international key informants (KIs), including patient representatives and people with lived experience. KIs characterised the contemporary landscape for MSK health and priorities for a global strategic response.
Phase 2: scoping review of national health policies to identify contemporary MSK policy trends and foci.
Phase 3: informed by phases 1–2, was a global eDelphi where multisectoral panellists rated and iterated a framework of priorities and detailed components/actions.

Results Phase 1: 31 KIs representing 25 organisations were sampled from 20 countries (40% low and middle income (LMIC)). Inductively derived themes were used to construct a logic model to underpin latter phases, consisting of five guiding principles, eight strategic priority areas and seven accelerators for action.

Phase 2: of the 165 documents identified, 41 (24.8%) from 22 countries (88% high-income countries) and 2 regions met the inclusion criteria. Eight overarching policy themes, supported by 47 subthemes, were derived, aligning closely with the logic model.
Phase 3: 674 panellists from 72 countries (46% LMICs) participated in round 1 and 439 (65%) in round 2 of the eDelphi. Fifty-nine components were retained with 10 (17%) identified as essential for health systems. 97.6% and 94.8% agreed or strongly agreed the framework was valuable and credible, respectively, for health systems strengthening.

Conclusion An empirically derived framework, co-designed and strongly supported by multisectoral stakeholders, can now be used as a blueprint for global and country-level responses to improve MSK health and prioritise system strengthening initiatives.

Key questions

What is already known?

- Musculoskeletal (MSK) conditions are the most significant contributors to the global burden of disability.
- Despite the burden of disease and multiple 'calls for action', global-level guidance for countries and a global strategic response to improve MSK health are lacking.

Key questions

What are the new findings?

- A global strategic response to improve MSK health and provide guidance to countries is strongly supported by multisectoral stakeholders.
- National-level policy guidance is nascent, substantiating the need for global-level guidance in health systems strengthening.
- Priority areas for action align with intuitive foci of the WHO Health System Building Blocks and a framework of eight priority areas (pillars) supported by 59 components are presented and validated.

What do the new findings imply?

- The proposed framework can now be used as a blueprint by global agencies, such as the WHO and others, to guide countries in formulating responses to address the burden of MSK health impairment.
- Given the scope for development of national health policy on MSK health, the framework is timely and strongly supported.
- Individual countries can adapt the framework to suit local contexts; this may be particularly useful for low-income settings where systems strengthening responses for MSK health are less developed and less prioritised.

INTRODUCTION

Musculoskeletal (MSK) health is essential for human function and quality of life. As a group of non-communicable diseases (NCDs) and common sequelae of injury and trauma, MSK conditions and persistent MSK pain account for the largest share of the global disability burden and largest group of conditions requiring rehabilitation across the lifecourse.[1 2] In 2019, MSK conditions comprised 17% of global years lived with disability (YLDs), and this estimate excludes YLDs associated with MSK injury and trauma and other conditions associated with persistent pain manifesting in MSK tissues and structures.[3] MSK conditions also account for significant healthcare expenditure (within the top five conditions by International Classification of Diseases classification), based on available data from member states of the Organisation for Economic Co-operation and Development (OECD),[4–6] however proportionate expenditure in low/middle-income countries (LMICs) remains uncertain. The prevalence and impact of MSK conditions, pain and trauma will continue to rise, on a background of rapid population ageing, increasing prevalence of other NCDs and their modifiable risk factors, and increasing rates of injury from minimal trauma fractures associated with bone fragility, falls and road traffic trauma. These circumstances are particularly relevant to LMICs, where the greatest need for care and rehabilitation exists; where the sharpest rise in the number of MSK-attributed YLDs is observed; and where significant disparities exist in awareness, priorities and access to MSK care.[1 2 7]

Despite unequivocal evidence of the disability burden related to MSK conditions and persistent pain of MSK aetiology,[3 8 9] substantial healthcare costs[5 10] and a propensity for delivery of low-value care in many health systems (eg, for back pain[11 12] and other persistent pain conditions[13 14]), targeted health systems strengthening responses are lacking nationally, regionally and globally.[7 13 15–18] While increased attention is warranted for those NCDs accounting for premature death (cancer, cardiovascular disease, lung disease, diabetes),[19] in parallel there is a strong rationale for more explicit integration of MSK conditions within a broader NCD agenda.[20 21] This is evidenced by: i) their relevance across the lifecourse (childhood to older age);[22] ii) common shared risk factors and effective interventions; iii) increased risk of developing NCDs with a prevalent MSK condition;[23] iv) frequent prevalence of pain and MSK conditions in NCD co- and multi-morbidity presentations;[24] and v) chronic disability and work loss.[25] Serial Global Burden of Disease (GBD) studies have identified the need for health systems to respond to the burden of MSK conditions, supported by calls in many other publications that MSK conditions should be assigned a greater level of priority in national and global health systems strengthening efforts.[16 26] This is further exemplified by 2000–2010 Bone and Joint Decade,[27] the *Lancet Series* on low back pain[28], the *Lancet Series* on chronic pain, [29] and planned *Lancet Commission* on osteoarthritis.[30]

The *Lancet Global Health Commission* argued that formulation of national policy to prioritise prevention and management of NCDs is essential for health systems strengthening.[31] In particular, global-level leadership is needed to guide countries in formulating and implementing appropriate system-level responses.[32] MSK health and pain are explicitly considered in integrated NCD health policies for some, but not all, of OECD member states,[20] in the WHO Europe NCD Action Plan[33] and within WHO health system reform initiatives to support healthy ageing[34] and rehabilitation in health systems.[35] However, system reform attention in LMICs for MSK health and explicit systems strengthening guidance from the WHO for action by member states remains scant. While health policy priorities for integrated management of NCDs are understood,[20] the priorities and directions of MSK-specific health policy remain unclear.

The aim of this research is to respond to the health systems strengthening - burden gap for MSK conditions, persistent MSK pain and MSK trauma by empirically deriving prioritised components for a global strategy for improving MSK health. The intentional outcome of this work is to provide a blueprint for a global strategy to support health systems strengthening for MSK health.

METHODS

Design

A three-phase, mixed-methods design was adopted, undertaken from May 2020 to February 2021, auspiced by the Global Alliance for Musculoskeletal Health (G-MUSC). The intention of the three-phase design was to enable diverse data to be collected from phases 1 and 2, which could triangulate to inform phase 3. These discrete phases are described below.

The manuscript is reported in alignment with the GRIPP2-sf and CREDES checklists (online supplemental files 1 and 2).[36 37] For the purpose of this report, '*MSK health*' includes MSK conditions, MSK pain, and MSK injury and trauma.

Patient and public involvement

The design and conduct of the research were overseen by an External Steering Group with explicit patient representation and input. The research intentionally involved patients and members of the public as participants. Patient advocates and advocacy organisations were purposively sampled to ensure that their views and perspectives were explicitly included.

Phase 1: qualitative study

Design

In-depth cross-sectional qualitative study of international key informants (KIs) across multiple health sectors and economies to understand the issues and strategic priorities around improving population-level MSK health, including describing key components of a global strategy.

Sampling and recruitment

Purposive sampling of KIs was undertaken across six cross-sectoral domains (online aggregated supplemental file), intentionally sampling representatives/affiliates of global or international peak organisations in healthcare and health systems strengthening, including patient advocacy organisations. A maximum heterogeneity approach was used across clinical disciplines, genders, geographical regions and economies. Sampling and recruitment have been reported in detail previously.[38] Briefly, KIs were identified as leaders of regional or global peak clinical and civil society organisations; representatives of WHO and national Ministries of Health; thought leaders in health systems strengthening and individuals with lived experience holding patient advocacy roles.

Data collection

Audio-recorded semi-structured interviews were conducted in English with each KI by one of three researchers (AMB, HS, JEJ). A semi-structured interview schedule (online aggregated supplemental file) was iteratively developed and piloted to explore KIs' perceptions relating to:

1. The current state of MSK health globally.
2. Actions needed at a global level to address MSK prevention and management to strengthen health systems.
3. The potential value of a global strategy to improve prevention and management of MSK health.
4. Requisite components for a global strategy, including goals of such a strategy.
5. Priorities and opportunities for improving prevention and management of MSK health aligned with the six objectives from the WHO Global Action Plan for Prevention and Control of NCDs (2013–2020).[39]

Data analysis

Verbatim transcripts were analysed inductively, applying a grounded theory approach by AMB and JEJ, using open, axial and selective coding to derive themes and subthemes across categories. Through selective coding, five categories of data were defined, from which a data-driven logic model was constructed. Categories included:

1. *Context*: a contemporary contextual factor associated with MSK health at the global level.
2. *Goals*: suggested goals or targets for a global strategy on MSK health.
3. *Guiding principles*: concepts or approaches that should underpin all activities or actions within a strategy.
4. *Accelerators*: processes or supports that enable action on strategic priority areas.
5. *Strategic priority areas or 'pillars'*: components or groups of actions considered important for a contemporary global strategy on MSK health.

In this paper, we focus on the strategic priority areas/pillars (category 5), whereas evidence for the other components of the logic model has been reported previously.[38] Within each pillar, a number of themes and sub-themes were inductively derived directly from the qualitative data. From these findings, we translated the themes and sub-themes into action-oriented components to build an empirical framework for the latter eDelphi phase (phase 3), consistent with a previously used approach.[40]

Phase 2: policy scoping review

Design

Scoping review of national health policies and strategies relevant to MSK health, based on the methodologic framework proposed by Arksey and O'Malley[41] and adapted by Anderson *et al*[42] for policy mapping. The review aimed to develop a snapshot of contemporary MSK-specific national policy approaches and priorities. The purpose was to enable policy learning from local policy action and to further inform the framework of components and actions for the eDelphi (phase 3).

Data collection

We defined an MSK policy document as:

1. Government issued; published by government departments or explicitly endorsed by government departments as representing the policy of a specified jurisdiction.
2. Targeting population-level improvement in MSK health; or containing substantial content dedicated to MSK health or any category of MSK health condition (eg, MSK pain, injury, MSK conditions).
3. Containing jurisdiction-wide strategies, action plans or system-level Models of Care or Models of Service Delivery,[43] consistent with an earlier approach.[20]

We searched for policy documents using:

1. A systematic online desktop search across the 30 most populated nations.

2. Identifying policy documents known to the G-MUSC International Coordinating Council members and known policy researchers (expert round), including access to raw data from an earlier integrated NCD policy review of OECD member states.[20]
3. Snowballing methods that also allowed for inclusion of multinational policies (online aggregated supplemental file).

We also supplemented the pool of documents after the first round of the eDelphi, where respondents were asked to suggest further national policy documents from their country of residence or birth for inclusion (see phase 3 methods). A subset of documents was reviewed by CHS against a priori inclusion criteria. These inclusion criteria were refined further after this initial document review (online aggregated supplemental file). Subsequently, CHS reviewed all policy documents in the yield against the refined inclusion criteria, with further independent verification by AMB and JJY where uncertainties about eligibility or classification were identified. SP then independently confirmed the eligibility of the final set of documents selected for inclusion in the scoping review.

Data analysis and synthesis

Text data were extracted from the policy documents and analysed inductively using content analysis to derive themes and subthemes,[44] consistent with the principles of a policy scoping review and established methods.[20 42] In this paper, we present the purpose and formats of the included policies, the MSK conditions included and the policy themes identified. A detailed analysis of themes and subthemes will be reported elsewhere.

Triangulation of data from phases 1 and 2

Data from phases 1 and 2 were triangulated to form an integrated framework of pillars and components in preparation for the phase 3 eDelphi study. As outlined above, data from phase 1 were used to derive the logic model of pillars and detailed components. These components were translated into action-oriented statements. The framework of policy-relevant themes and subthemes derived from the phase 2 policy scoping review was then considered alongside the framework of pillars and actions derived from phase 1 to identify areas of concordance, discordance and gaps. Through a series of meetings, the project team integrated the data from phase 2 into the framework derived from phase 1 to triangulate the datasets. This integrated framework was used as the foundation for the phase 3 eDelphi study.

Phase 3: global eDelphi

Design

A two-round eDelphi was undertaken between October 2020 and January 2021, using Qualtrics (Provo, Utah, USA) software. The eDelphi aimed to present the triangulated findings from phase 1 and phase 2 to a larger global sample.

Sampling and recruitment

Using convenience and purposive methods that aimed to maximise international reach, eDelphi participants were sampled as individuals and organisations across nine multisectoral sampling categories (online aggregated supplemental file). A multipronged sampling frame was developed to include: existing contact databases held by G-MUSC (compliant with privacy standards); a systematic desktop search of clinical and civil society organisations relevant to MSK health and disability across the 30 most populated nations based on United Nations (UN) World Population Prospects (online aggregated supplemental file); and through open invitations on social media platforms. Recruitment was facilitated independent to the research team by the G-MUSC home office (Sydney, Australia).

Data collection

In round 1, the eDelphi survey comprised demographic variables, items reflecting requisite components of a global strategy for MSK health derived from phases 1 and 2 (Numerical Rating Scale of importance (1–9) and a 'do not know' option); an item for free-text comments; a free-text item allowing for identification of MSK national policy in the respondent's country of residence or birth, and an overall rating of support for the draft framework of components (Likert scale 1 (strongly object) to 5 (strongly support)). In round 2, respondents re-rated any components that did not meet the threshold for retention in round 2, identified which components were 'essential' (3-point Nominal Response Scale: essential, desirable, unsure), and rated the overall framework for value and credibility (Likert scale 1 (strongly disagree) to 5 (strongly agree)). Since each survey item was written in a brief format, each round was supported by a detailed guidebook, providing explanatory notes. online aggregated supplemental file contain the survey tools and the round 2 guidebook. The guidebook contained detailed information about the scope of each component.

Data analysis

Demographic data were analysed descriptively. Quantitative responses were analysed using the RAND-UCLA method.[45] Across the items in round 1, the panel median was categorised as 1–3: 'not important', 4–6: 'equivocal' or 7–9: 'important'. An item was defined as 'important' and retained for round 2 where the overall panel median score was ≥7 with level of agreement of ≥70% by panellists within the band 7–9. An item with a panel median of 4–6 or other median band with a consensus of <70% within that band was defined as 'uncertain' and flagged for rerating in round 2. An item with a panel median of 1–3 and a level of agreement of ≥70% by panellists within the band 1–3 was defined as 'unimportant' and removed from the framework. Free-text comments were analysed using a summative content analysis method. Codes were inductively derived to describe

the content of free-text comments and then counted to provide an indication of relative prominence of the code, consistent with established methods.[46 47] In round 2, any items requiring re-scoring were analysed in the same way. Frequencies were used to analyse selections for essential items and overall ratings for the framework. An item was considered 'essential' where ≥80% of the panel ranked it as essential, consistent with established thresholds.[40 48]

RESULTS

Qualitative study (phase 1)

Thirty-one KIs (45% women) from 20 countries (40% LMICs) with a mean (SD) of 30.4 (11.2) years of experience in healthcare participated in phase 1. Collectively, the KIs represented 25 peak organisations, including global and regional organisations (online aggregated supplemental file). Across the KIs, 4 (13%) were patient representatives of international or global organisations, while 7 (23%) had a lived experience of an MSK health condition/persistent MSK pain for at least 5 years and 22 (71%) were registered clinicians.

The qualitative data defined the logic model (figure 1) for a global strategy for MSK health, organised as a framework of eight pillars/priority areas, underpinned by detailed components/actions. The pillars and their components/actions were supported by five guiding principles and seven accelerators, described previously.[38] Each component was data driven with detailed commentaries and supporting quotes for each component outlined in online aggregated supplemental file.

Policy scoping review (phase 2)

One hundred sixty-five policy documents were identified with 41 (24.8%)[49–89] retained after exclusions and removal of duplicates, representing 22 countries (20 (90.9%) high-income nations; 2 (9.1%) upper middle-income nations) including: Australia,[50–52] Belgium,[53] Canada,[49 66 85] Chile,[63] Columbia,[71] Denmark,[72] Finland,[62] France,[69 70] Hungary,[64] Italy,[58] Ireland,[81] New Zealand,[73 74 76] Norway,[59 77] Portugal,[57] Republic of Korea,[68] Spain,[55] Switzerland,[83 84] Turkey,[79] UK (England),[56 80 86] UK (Scotland),[82 87] UK (Wales),[89] and USA[65 67 75 78 88]; and two multi-national regions (European Union,[60 61] international[54]) (online aggregated supplemental file). We did not identify any eligible documents from LMICs, however, a number of MSK-relevant documents from LMICs were identified from the search (online aggregated supplemental file). Of the 124 excluded documents, most were classified as clinical guidelines (n=56; 45.2%), government reports on burden of disease (n=14; 11.3%), non-government calls to action (n=13; 10.5%) and other non-policy literature (n=14; 11.3%).

A wide variety of documents, purposes and formats was identified, ranging from extensive reviews of the current health system, MSK services and disease burden, to standalone tables of goals and roles and responsibilities. Nine of the included documents had a primary focus MSK health in a broad sense,[54 56 61 76 79 80 84 86 87] but of these only three were specifically designed as national system-wide policies for MSK health.[56 79 84] Of the remaining 32 documents, 12 had a primary focus on pain,[50 53 55 57 62 65–67 69 82 85 89] 6 had a primary focus on occupational health,[59 60 70 71 75 88] 3 had a primary focus on osteoarthritis,[49 52 78] 3 had a primary focus on low back pain,[72–74] 1 had a primary focus on rheumatic inflammatory conditions,[81] and 1 had a primary focus on osteoporosis and fragility fractures.[52] A further six documents addressed broader health policy as a primary focus (eg, NCDs or a national health plan) and contained a substantial component on general MSK health.[58 63 64 68 77 83]

We inductively identified eight policy themes, supported by 47 sub-themes (online aggregated supplemental file). Close alignment was observed between these inductively derived policy themes/sub-themes and the empirically derived pillars of the logic model derived in phase 1, providing concurrent validation of the logic model. The 'data and information systems' theme was a distinct theme to the policy review. Across the policy documents, the most broadly covered theme was 'service delivery' (nine sub-themes), followed by 'workforce' (eight sub-themes), and 'medicines and technologies' and 'financing' (six sub-themes each). Other themes were described in less breadth, including 'data and information systems' (five sub-themes); 'leadership and governance' (five sub-themes); 'citizens, consumers and communities' (four sub-themes); and 'research and innovation' (four sub-themes).

eDelphi (phase 3)

Figure 2 summarises the recruitment flow for the eDelphi, with 674 valid responses recorded for round 1 and 439 (65%) for round 2. Demographic characteristics of the Delphi panel are summarised in table 1. Most respondents identified as registered clinicians with approximately half concurrently holding academic roles. Across the eDelphi rounds, approximately 20% (15%–26%) of panellists identified as living with an MSK condition, being an officer of a clinical or professional organisation, working in health policy or service design, or being a thought leader. Seventy-two countries were represented in round 1 (46% LMICs) and 66 in round 2 (44% LMICs), representing all UN geographic regions, with most panellists residing in Europe and Central Asia (36%–39% across rounds 1-2) and North America (27%–24% across rounds 1-2) (figure 3). The 109 panellists who identified as providing an organisation-level response in round 1 represented 116 unique organisations (online aggregated supplemental file).

Fifty-nine (98%) framework components/actions presented in round 1 met the threshold for retaining, with no difference observed between participants

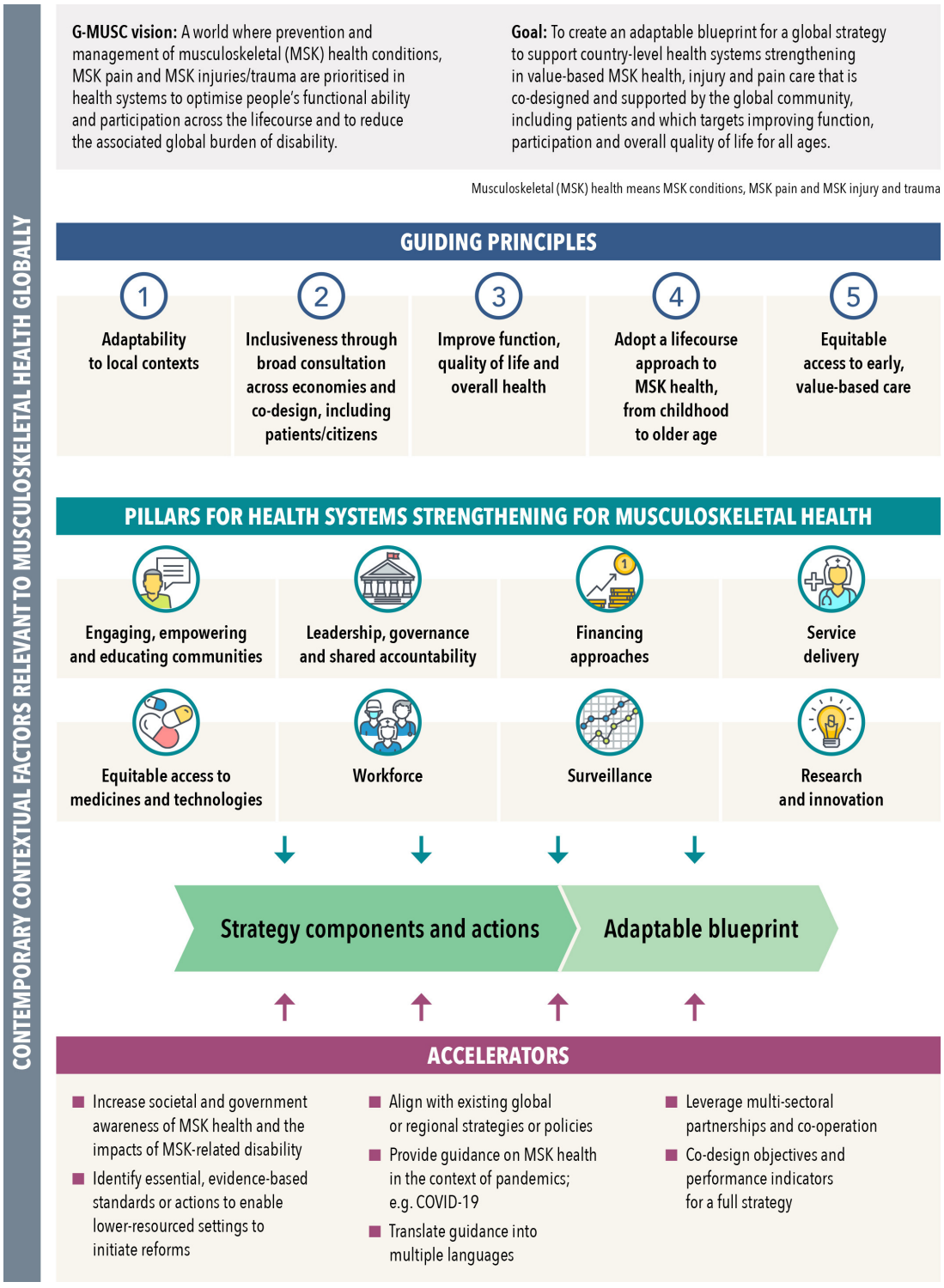

Figure 1 Data-derived logic model for a global strategy for musculoskeletal (MSK) health, re-designed from Briggs *et al*.[38] The focus of this paper is on the eight pillars. Terminologies are aligned with those described by Menear *et al*[93] for learning health systems. 'MSK health' refers to established MSK conditions, MSK pain and MSK injury and trauma.

in high-income countries and LMICs. Free-text comments were received from 136 panellists in round 1 and thematically analysed to revise the draft framework (data not shown). The single item (1.1d) re-scored in round 2 did not meet the threshold for inclusion (median: 7 with 62.9% of panel responses in the 7–9 band) and was therefore removed from the final framework; resulting in 59 components across eight pillars (table 2). Ten (17%) components were identified as essential for health systems by the pooled panel, while 15 (25%) were identified as essential by panellists from LMICs (table 2). Across the 59 components, 'unsure' ratings ranged from 0% to 20%, with most unsure ratings appearing in pillar 3: financing.

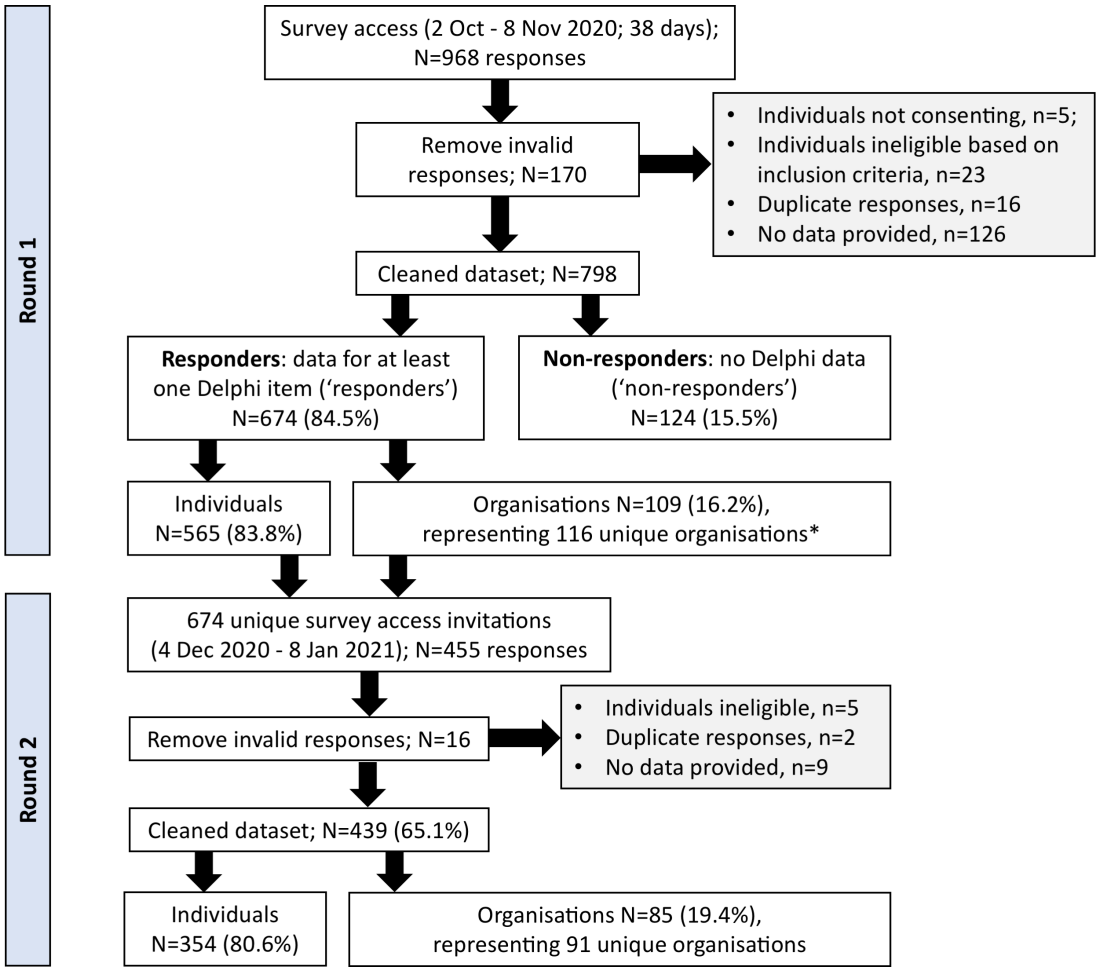

Figure 2 Sampling and data processing flow chart for phase 3. *Individuals could represent more than one unique organisation.

At the conclusion of round 1, 96.8% of panellists supported or strongly supported the draft framework. In round 2, 97.6% and 94.8% agreed or strongly agreed the framework was valuable and credible, respectively, for health systems strengthening. No differences in ratings were observed in sensitivity analysis for high-income versus LMICs, individuals versus organisations, or clinicians versus non-clinicians.

DISCUSSION

Given the significant global disability burden associated with MSK conditions, MSK pain and MSK injury and trauma, many and sustained international 'calls for action' on MSK health have been made. Calls for action typically focus on 'what' needs to be done, but not necessarily 'how' to do it and often fail to be data-driven and co-designed with a representative global community that includes people with lived experience.[3] This research addresses this key gap. Our scoping review identified that few national system-level strategic policies addressing MSK health exist, highlighting the need for global-level guidance in policy formulation, in particular. We present here, for the first time, a strategic framework for national MSK health policy and service delivery that has been data driven, co-designed with a representative global community including people with lived experience, and adopts a lifecourse perspective (including children and young people). We have empirically derived contemporary, requisite components for a global strategic response to improve population-level prevention and management of MSK health impairments. The eight priority areas (pillars) with specific components/actions defined from the qualitative phase were strikingly similar to the policy scoping outcomes, suggesting construct validity of the logic model. The eDelphi study further validated these findings and provided evidence for strong international and multisectoral support for the framework, irrespective of economic setting.

The eight pillars and their components of the logic model reflect the scope of health systems strengthening at a whole-of-system (macro) level and service (meso) level, consistent with system transformation initiatives in healthy ageing, rehabilitation and pain care.[13 40 90 91] There was close alignment of our derived eight pillars for action and their components with existing models including the WHO Health Systems

Table 1 Demographic characteristics of the eDelphi panel at rounds 1 and 2. Data are presented as mean (95% CI) for continuous data and frequency count (%) for categorical data.

Characteristic	Panel round 1 (n=674)	Panel round 2 (n=439; 65.1%)
Age	48.3 (47.3 to 49.3)	49.7 (48.5 to 50.8)
Gender	male: 351 (52.1); female: 316 (46.9); other: 7 (1.0)	male: 231 (52.6); female: 206 (46.9); other 2 (0.5)
Type of response		
Individual	565 (83.8)	354 (80.6)
Organisation	109 (16.2)	85 (19.4)
Category of responder*		
Person with a lived experience of MSK health condition	149 (22.1)	94 (21.4)
Registered clinician/health worker	517 (76.7)	332 (75.6)
Officer of a clinical/professional organisation	149 (22.1)	115 (26.2)
Health policy, service design/implementation officer	103 (15.3)	74 (16.9)
Advocacy role	126 (18.7)	87 (19.8)
Thought leader†	128 (19.0)	91 (20.7)
Academic or workforce training position	290 (43.0)	199 (45.3)
WHO officer	3 (0.4)	3 (0.7)
National Ministry of Health officer	8 (1.2)	6 (1.4)
Total years healthcare experience	21.1 (20.2 to 22.0)	22.2 (21.1 to 23.3)
Total years lived experience with MSK health condition‡	18.7 (16.4 to 21.0)	20.9 (17.9 to 23.9)
Economic band (World Bank Classifications 2020§)		
High income: by country; by participant	39 (54.2); 494 (73.3)	37 (56.1); 329 (74.9)
Low and middle-income: by countries; by participant	33 (45.8); 180 (26.7)	29 (43.9); 110 (25.1)
Global geographic regions: n (%) participants		
East Asia and Pacific	114 (16.9)	80 (18.2)
Europe and Central Asia	241 (35.8)	172 (39.2)
Latin America and Caribbean	54 (8.0)	25 (5.7)
Middle East and North Africa	11 (1.6)	5 (1.1)
North America	179 (26.6)	106 (24.1)
Sub-Saharan Africa	33 (4.9)	22 (5.0)
South Asia	42 (6.2)	29 (6.6)
Highest level of education		
Secondary/high school	5 (0.7)	5 (1.1)
Diploma/certificate/apprenticeship	16 (2.4)	6 (1.4)
University bachelor's degree	83 (12.3)	56 (12.8)
University higher degree (Master's)	200 (29.7)	129 (29.4)
University higher degree (PhD)	229 (34.0)	164 (37.4)
University higher degree (other)	141 (20.9)	79 (18.0)
Clinical disciplines	517 (76.7)	332 (75.6)
Complementary medicine practitioner	1 (0.2)	0 (0)
Anaesthetist/anaesthesiologist	17 (3.3)	10 (3.0)
Chiropractor	68 (13.2)	52 (15.7)

Continued

Table 1 Continued

Characteristic	Panel round 1 (n=674)	Panel round 2 (n=439; 65.1%)
Dietitian/nutritionist	1 (0.2)	1 (0.3)
Emergency medicine physician	1 (0.2)	1 (0.3)
Endocrinologist	2 (0.4)	2 (0.6)
Exercise physiologist/scientist	2 (0.4)	2 (0.6)
General physician	1 (0.2)	1 (0.3)
Gerontologist/geriatrician	1 (0.2)	1 (0.3)
Infectious diseases physician	2 (0.4)	1 (0.3)
Kinesiologist	1 (0.2)	0 (0)
Neurologist	3 (0.6)	3 (0.9)
Nurse/nurse practitioner	6 (1.2)	3 (0.9)
Occupational therapist	23 (4.4)	15 (4.5)
Orthopaedic surgeon	41 (7.9)	23 (6.9)
Osteopath	3 (0.6)	3 (0.9)
Other manual therapist	4 (0.8)	2 (0.6)
Paediatrician	5 (1.0)	4 (1.2)
Physician assistant	1 (0.2)	1 (0.3)
Physiotherapist/physical therapist	222 (42.9)	127 (38.3)
Podiatrist/chiropodist	3 (0.6)	2 (0.6)
Primary care/family physician	4 (0.8)	1 (0.3)
Psychologist/clinical psychologist	2 (0.4)	2 (0.6)
Public health physician	2 (0.4)	1 (0.3)
Rehabilitation and physical medicine physician	42 (8.1)	29 (8.7)
Rheumatologist (including paediatric rheumatologist)	60 (11.6)	45 (13.6)

*Categories are not mutually exclusive; hence proportions exceed 100%.
†Defined as having published at least two peer-reviewed papers or health policies in the last 5 years related to global health systems or health services reform for MSK health, MSK pain, injury, non-communicable disease, ageing, disability or rehabilitation.
‡Answered only by panellists who identified as living with an MSK health condition for at least 5 years.
§World Bank Classifications: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.
MSK, musculoskeletal; WHO, World Health Organization.

Building Blocks model[92] and a contemporary framework of value-creating learning health systems.[93] Together with findings from the policy review, this provides confidence in the construct validity of our proposed logic model and should facilitate interpretation and adoption by policymakers and other stakeholders.

The most prominent pillars, evidenced by the strength of qualitative data, were 'engaging, empowering and educating' (pillar 1); 'leadership, governance and shared accountability' (pillar 2); 'service delivery' (pillar 4); and 'research and innovation (pillar 8)'. Cross-cutting themes across these areas were the importance of a lifecourse approach (including children), targeting improvement in function and quality of life, and reducing health inequity, as articulated in the five guiding principles of the logic model. Importantly, these data-driven guiding principles also align with other global initiatives, for example, the WHO Rehabilitation 2030 Agenda;[94] WHO Framework on integrated, people-centred health services;[32] WHO Global Strategy on Human Resources for Health: Workforce 2030;[95] WHO Model of Healthy Ageing;[96] and the UN Decade of Healthy Ageing 2020–2030.[91] Harmonisation of principles with these extant frameworks will be important for adoption and facilitating implementation activity.

Cross-sectoral partnerships (pillar 1); global and national leadership on MSK health prioritisation and extending health indicators to consider function (pillar 2); and early diagnosis, triage and prioritising high-value care (pillar 4) were considered essential components by the eDelphi panel. While there were less granular data on financing models (pillar 3) and access to essential medicines and technologies (pillar 5), panellists still identified essential components within these pillars. Although building population health surveillance capacity

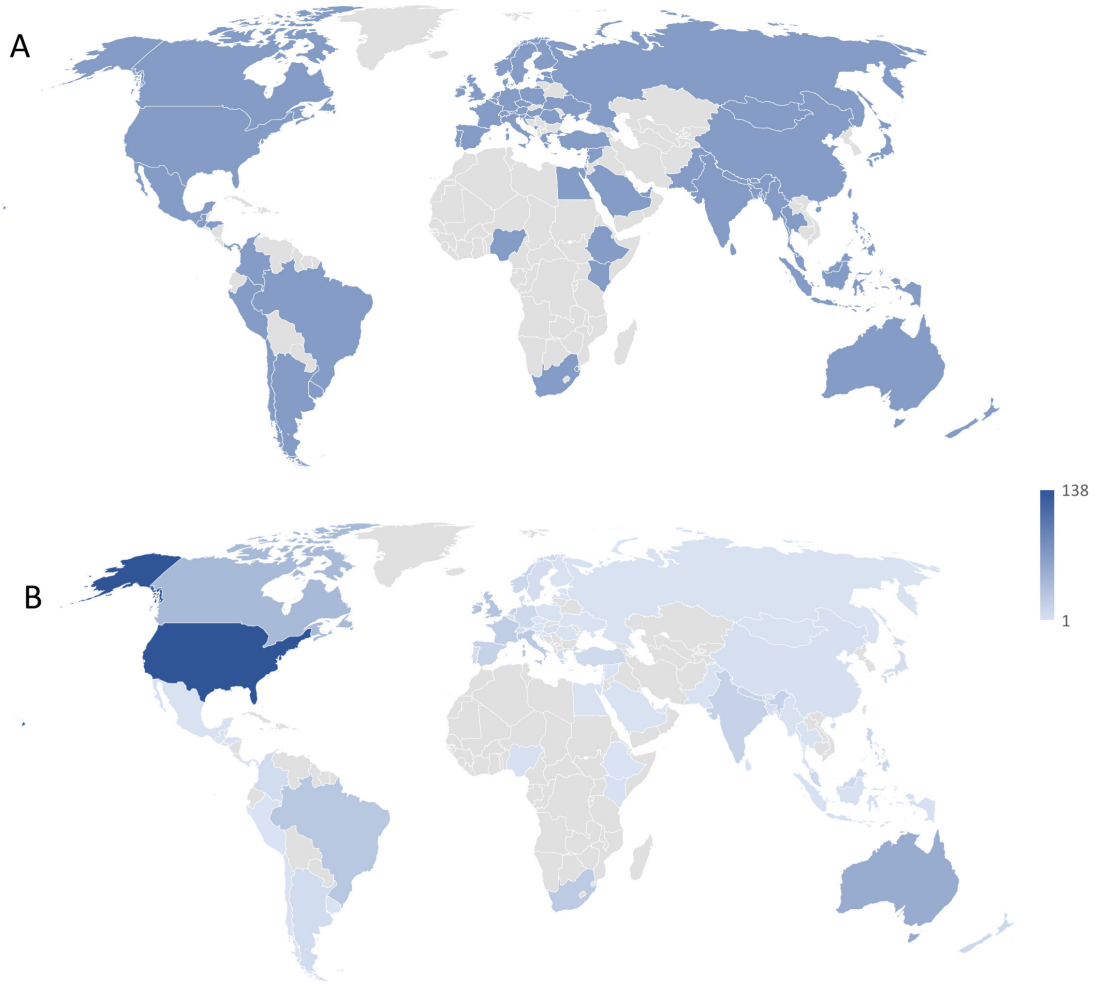

Figure 3 Global geographic heatmap of participants in phase 3, powered by Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA). The continent of Antarctica is excluded from the image. (A) Illustrates the distribution of countries represented in phase 3 (n=72). Consistent blue shading reflects the countries represented. (B) Illustrates the distribution of participants (n=674) by country, ranging from 1 to 138 participants by country, represented by graded shading where darker shading indicates a greater number of participants in a given country.

(pillar 7) was considered important, it did not meet the threshold for an essential component (scored by 77% of the panel, rather than the threshold of 80%). This observation resonates with recent findings of limited inclusion of MSK conditions in population health surveys.[97] We infer this may be due to the strong representation of clinician panellists placing more emphasis on community engagement and service delivery components, compared with system-level actions like population health surveillance. Panellists from LMICs identified more components as 'essential' compared with panellists from high-income settings. Specifically, leadership from the WHO; establishment of essential packages of care; inclusion of MSK health in primary and secondary prevention initiatives for NCDs; access to low-cost technologies and interventions; building capacity in the primary care workforce and educating health practitioners were considered essential by panellists in LMICs, which likely reflects key priorities in these settings. These setting-specific differences in priorities underline the importance of providing global-level guidance that is adaptable to local context; a point strongly enforced by KIs, *'You can't take a strategy from one country and just implement it in another country'* (ID4, France) and also a guiding principle in the logic model. While strongly supported, no components in the 'research and innovation' pillar were considered 'essential', suggesting that the panel prioritised health systems strengthening in other areas at this time. Similarly, the panel rating of importance for item 1.1d, relating to the built environment, was below the threshold for inclusion. This suggests the panel placed more importance on direct health system strengthening efforts, despite KIs' perceptions in phase 1, recent evidence,[98] and a programme of work in WHO positioning the importance of the built environment for optimising functional ability in people with MSK health conditions and older people (eg, WHO Global Network for Age-friendly Cities and Communities). The box below highlights the essential actions required at a global

Table 2 Summary of quantitative outcomes from eDelphi rounds 1 and 2. The component descriptions reflect the revisions applied after free-text data analysis from Round 1 and additions from the Phase 2 policy scoping review. Bolded scores reflect those components identified as essential by at least 80% of the panel.

	Pooled panel					High-income countries panel					Low/middle-income countries panel				
	Round 1			Round 2		Round 1			Round 2		Round 1			Round 2	
Component	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N
Pillar 1: engaging, empowering and educating citizens, communities, organisations and governments to act on MSK health															
1.1a: improving prevention and management of MSK health requires engagement and partnerships with citizens, patients and civil society organisations.	9 (1)	610 (90.6)	674	**391 (90.1)***	434	9 (1)	444 (89.9)	494	**293 (90.4)***	324	9 (1)	166 (92.2)	180	**98 (89.1)***	110
1.1b: improving prevention and management of MSK health requires engagement and partnerships with industry, workplaces and employers.	8 (2)	582 (86.4)	674	**351 (80.9)***	434	8 (2)	427 (86.4)	494	**264 (81.5)***	324	8 (2)	155 (86.1)	180	87 (79.1)	110
1.1c: improving prevention and management of MSK health requires engagement and partnerships with third-party payers/insurers.	7 (2)	522 (77.4)	674	281 (64.7)	434	8 (2)	393 (79.6)	494	212 (65.4)	324	8 (3)	129 (71.7)	180	69 (62.7)	110
1.1d: improving prevention and management of MSK health requires engagement and partnerships with the built environment sector.	8 (2)	421 (62.5)	674	n/r	n/r	7 (2)	295 (59.7)	494	n/r	n/r	8 (3)	126 (70.0)	180	n/r	n/r
1.1e: improving prevention and management of MSK health requires engagement and partnerships with schools and education facilities.	9 (1)	545 (80.9)	674	308 (71.0)	434	8 (2)	394 (79.8)	494	222 (68.5)	324	8 (2)	151 (83.9)	180	86 (78.2)	110
1.1f: improving prevention and management of MSK health requires engagement and partnerships with national and subnational governments.	9 (1)	592 (87.8)	674	**363 (83.6)***	434	9 (1)	432 (87.4)	494	**274 (84.6)***	324	9 (1)	160 (88.9)	180	**89 (80.9)***	110
1.2: improving prevention and management of MSK health requires education across the following sectors: schools and higher education facilities; workplaces; health professionals and the community.	9 (1)	643 (96.4)	667	**398 (91.7)***	434	9 (1)	471 (96.1)	490	**293 (90.4)***	324	9 (1)	172 (97.2)	177	**105 (95.5)***	110
1.3: improving prevention and management of MSK health requires globally relevant educational messages contextualised to local settings.	9 (1)	624 (93.6)	667	310 (71.4)	434	9 (1)	458 (93.5)	490	228 (70.4)	324	9 (1)	166 (93.8)	177	82 (74.5)	110
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.	8 (1)	606 (91.7)	661	279 (64.3)	434	8 (2)	446 (91.8)	486	213 (65.7)	324	9 (1)	160 (91.4)	175	66 (60.0)	110

Continued

Table 2 Continued

Component	Pooled panel					High-income countries panel					Low/middle-income countries panel				
	Round 1			Round 2		Round 1			Round 2		Round 1			Round 2	
	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N
Pillar 2: leadership, governance and shared accountability															
2.1: MSK health should be explicitly integrated with broader reform efforts for non-communicable diseases (NCDs).	9 (1)	587 (90.9)	646	297 (68.9)	431	9 (1)	435 (92.2)	472	212 (66.0)	321	8 (1.25)	152 (87.4)	174	85 (77.3)	110
2.2: Universal Health Coverage essential care packages and/or insurance schemes should include prevention and management of MSK health impairment.	9 (1)	589 (90.3)	652	314 (72.9)	431	9 (1)	430 (89.6)	480	232 (72.3)	321	9 (1)	159 (92.4)	172	82 (74.5)	110
2.3: strategic global responses for MSK health should explicitly link with and support implementation of existing global and national health systems strengthening efforts.	9 (1)	609 (94.1)	647	289 (67.1)	431	9 (1)	449 (94.1)	477	212 (66.0)	321	9 (1)	160 (94.1)	170	77 (70.0)	110
2.4: global leadership from the WHO in prioritising MSK health is essential to drive a global response to the burden of MSK health impairment.	8 (2)	559 (88.0)	635	320 (74.2)	431	8 (2)	411 (88.0)	467	232 (72.3)	321	9 (1.75)	148 (88.1)	168	**88 (80.0)***	110
2.5: country-level leadership is needed to prioritise MSK health impairment by national governments.	9 (1)	610 (95.9)	636	**366 (84.9)***	431	9 (1)	450 (95.7)	470	**275 (85.7)***	321	9 (1)	160 (96.4)	166	**91 (82.7)***	110
2.6: leadership is needed from professional and civil societies and citizens that extends beyond just MSK health.	8 (2)	531 (83.2)	638	256 (59.4)	431	8 (2)	393 (83.3)	472	186 (57.9)	321	8 (2)	138 (83.1)	166	70 (63.6)	110
2.7: global and national multi-sectoral and inter-ministerial leadership is needed to prioritise action on policy and financing for MSK health.	8 (2)	550 (88.9)	619	264 (61.3)	431	8 (2)	408 (89.9)	454	198 (61.7)	321	8 (2)	142 (86.1)	165	66 (60.0)	110
2.8: global and national health and performance indicators must extend beyond mortality reduction to consider function and participation.	9 (1)	610 (96.2)	634	**368 (85.4)***	431	9 (1)	452 (96.6)	468	**274 (85.4)***	321	9 (1)	158 (95.2)	166	**94 (85.5)***	110
2.9: a meaningful, acceptable and internationally comparable classification system is needed for MSK health.	8 (2)	557 (89.4)	623	268 (62.2)	431	8 (2)	401 (87.6)	458	193 (60.1)	321	9 (1)	156 (94.5)	165	75 (68.2)	110
2.10: legislation and regulation are needed to sustain reform efforts in health systems strengthening for NCDs, including MSK health.	8 (2)	535 (87.2)	614	274 (63.6)	431	8 (2)	383 (85.3)	449	199 (62.0)	321	8 (1)	152 (92.1)	165	75 (68.2)	110
Pillar 3: financing															
3.1: existing healthcare financing models need to integrate health promotion and healthcare delivery for MSK health.	8 (1)	574 (92.7)	619	**344 (80.2)***	429	9 (1)	420 (92.1)	456	253 (79.1)	320	8 (1)	154 (94.5)	163	**91 (83.5)***	109

Continued

Table 2 Continued

Component	Pooled panel					High-income countries panel					Low/middle-income countries panel				
	Round 1			Round 2		Round 1			Round 2		Round 1			Round 2	
	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N
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.	8 (2)	480 (76.7)	626	214 (49.9)	429	8 (1)	343 (74.4)	461	146 (45.6)	320	8 (2)	137 (83.0)	165	68 (62.4)	109
3.3: support multinational foreign aid for MSK care in low-resource settings.	8 (2)	474 (75.7)	626	215 (50.1)	429	8 (2)	334 (72.4)	461	143 (44.7)	320	9 (1)	140 (84.8)	165	72 (66.1)	109
3.4: allocated funding, essential medicines funding and donor funding for MSK health and injury care need to be quarantined.	8 (2)	465 (74.6)	623	178 (41.5)	429	8 (2)	323 (70.5)	458	117 (36.6)	320	8 (2)	142 (86.1)	165	61 (56.0)	109
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.	8 (1)	554 (89.8)	617	340 (79.3)	429	9 (1)	408 (89.5)	456	**262 (81.9)***	320	8 (2)	146 (90.7)	161	78 (71.6)	109
3.6: financing models should incentivise prevention and integrated interdisciplinary care for MSK health conditions.	9 (1)	554 (89.8)	617	318 (74.1)	429	9 (1)	414 (90.8)	456	243 (75.9)	320	8 (2)	140 (87.0)	161	75 (68.8)	109
Pillar 4: service delivery															
4.1: service models for MSK conditions need to support early diagnosis and triage and management through local care pathways.	9 (1)	574 (93.0)	617	**354 (82.7)***	428	9 (1)	421 (92.3)	456	**261 (81.8)***	319	9 (1)	153 (95.0)	161	**93 (85.3)***	109
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.	9 (1)	564 (91.7)	615	335 (78.3)	428	9 (1)	416 (91.6)	454	247 (77.4)	319	9 (1)	148 (91.9)	161	**88 (80.7)***	109
4.3: services for MSK healthcare should be integrated with service models for NCDs and services that target the broader social determinants of health.	8 (2)	541 (88.5)	611	260 (60.7)	428	8 (2)	395 (87.8)	450	188 (58.9)	319	8 (1)	146 (90.7)	161	72 (66.1)	109
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 (low-value).	9 (1)	560 (92.1)	608	**351 (82.0)***	428	9 (1)	411 (91.9)	447	**256 (80.3)***	319	9 (1)	149 (92.6)	161	**95 (87.2)***	109

Continued

Table 2 Continued

Component	Pooled panel					High-income countries panel					Low/middle-income countries panel				
	Round 1			Round 2		Round 1			Round 2		Round 1			Round 2	
	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N
4.5: service models for MSK conditions should support integrated, person-centred care that targets functional ability through a biopsychosocial approach.	9 (1)	574 (94.4)	608	334 (78.0)	428	9 (1)	422 (94.4)	447	249 (78.1)	319	9 (1)	152 (94.4)	161	85 (78.0)	109
4.6: service models for MSK healthcare should promote community-based interdisciplinary care.	8 (1)	565 (93.2)	606	280 (65.4)	428	9 (1)	416 (93.3)	446	204 (63.9)	319	8 (1)	149 (93.1)	160	76 (69.7)	109
4.7: MSK care should be integrated into existing community-based or regionally based service models for NCD care.	8 (1)	541 (89.9)	602	248 (57.9)	428	8 (2)	394 (88.7)	444	182 (57.1)	319	9 (1)	147 (93.0)	158	66 (60.6)	109
4.8: community-led service models for MSK healthcare should be co-designed by the community.	8 (2)	520 (86.5)	601	189 (44.2)	428	8 (2)	379 (85.4)	444	141 (44.2)	319	9 (1.5)	141 (89.8)	157	48 (44.0)	109
4.9: service models should prioritise access to health information and care to vulnerable groups.	8 (1)	544 (90.5)	601	267 (62.4)	428	8 (2)	399 (89.9)	444	190 (59.6)	319	9 (1)	145 (92.4)	157	77 (70.6)	109
4.10: primary and secondary prevention initiatives for NCDs should include MSK health.	8 (2)	541 (90.5)	598	330 (77.1)	428	8 (2)	397 (90.0)	441	242 (75.9)	319	8 (2)	144 (91.7)	157	**88 (80.7)***	109
4.11: MSK-specific primary prevention initiatives should be delivered where evidence of clinical and cost-effectiveness exists.	9 (1)	562 (94.0)	598	317 (74.1)	428	9 (1)	415 (94.1)	441	235 (73.7)	319	9 (1)	147 (93.6)	157	82 (75.2)	109
4.12: national injury (sport, workplace, falls) and trauma prevention strategies and campaigns are needed.	8 (2)	499 (83.4)	598	237 (55.4)	428	8 (2)	359 (81.4)	441	164 (51.4)	319	9 (2)	140 (89.2)	157	73 (67.0)	109
Pillar 5: equitable access to medicines and technologies															
5.1: countries need to identify, resource and provide access to essential therapeutics for priority MSK conditions.	8 (2)	516 (86.4)	597	**345 (80.8)***	427	8 (2)	371 (84.3)	440	**256 (80.3)***	319	9 (1)	145 (92.4)	157	**89 (82.4)***	108
5.2: global and national prioritisation and management are needed in innovation of, and access to, low-cost assistive devices, technologies and interventions that support function and participation.	8 (2)	493 (82.6)	597	288 (67.4)	427	8 (2)	353 (80.2)	440	201 (63.0)	319	9 (1)	140 (89.2)	157	**87 (80.6)***	108
Pillar 6: workforce (building workforce capacity, systems and tools)															
6.1: increase the number of medical specialists and allied health practitioners for MSK healthcare in LMICs.	8 (2)	470 (78.9)	596	275 (64.4)	427	8 (2)	337 (76.8)	439	193 (60.5)	319	8 (2)	133 (84.7)	157	82 (75.9)	108

Continued

Table 2 Continued

Component	Pooled panel					High-income countries panel					Low/middle-income countries panel				
	Round 1			Round 2		Round 1			Round 2		Round 1			Round 2	
	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N
6.2: build capacity in the local existing community-based workforce to contribute to basic MSK health and injury care.	8 (1)	535 (89.8)	596	294 (68.9)	427	8 (2)	389 (88.6)	439	206 (64.6)	319	9 (1)	146 (93.0)	157	**88 (81.5)***	108
6.3: establish flexible service models to enable the non-medical workforce (eg, 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.	9 (1)	538 (90.4)	595	289 (67.7)	427	9 (1)	396 (90.4)	438	220 (69.0)	319	9 (1)	142 (90.4)	157	69 (63.9)	108
6.4: integrate MSK health into curricula across medical disciplines and increase the number of MSK medical specialist training positions in LMICs.	8 (2)	503 (84.7)	594	317 (74.2)	427	8 (2)	360 (82.4)	437	233 (73.0)	319	9 (1)	143 (91.1)	157	84 (77.8)	108
6.5: build skills-based competencies across medical, nursing and allied health disciplines (and non-clinical roles in LMICs) in the identification of MSK health problems and basic prevention and management practices.	9 (1)	561 (94.4)	594	317 (74.2)	427	9 (1)	409 (93.6)	437	236 (74.0)	319	9 (1)	152 (96.8)	157	81 (75.0)	108
6.6: extend training curricula for prelicensure medical, nursing, pharmacy and allied health clinicians in MSK health, persistent pain and injury care within a person-centred, biopsychosocial model.	8 (2)	525 (88.4)	594	286 (67.0)	427	8 (2)	388 (88.8)	437	213 (66.8)	319	8 (2)	137 (87.3)	157	73 (67.6)	108
6.7: educate healthcare workers and health planners to deliver information and care aligned to positive health behaviours for MSK health and other NCDs.	8 (1)	544 (91.6)	594	318 (74.5)	427	8 (1)	398 (91.1)	437	232 (72.7)	319	9 (1)	146 (93.0)	157	**86 (79.6)***	108
6.8: increase remuneration for the health workforce in LMICs to maintain workforce volumes.	8 (2)	465 (78.3)	594	241 (56.4)	427	8 (2)	326 (74.6)	437	157 (49.2)	319	9 (1)	139 (88.5)	157	84 (77.8)	108
Pillar 7: surveillance (monitoring population health)															
7.1: build country-level population health surveillance capacity to monitor incidence, prevalence and impact of MSK conditions.	8 (2)	304 (84.8)	594	282 (66.0)	427	8 (2)	363 (83.1)	437	206 (64.6)	319	8 (2)	141 (89.8)	157	76 (70.4)	108
7.2: include metrics on function, participation, quality of life and care experience in national health surveillance systems.	8 (2)	531 (89.4)	594	329 (77.0)	427	8 (2)	386 (88.3)	437	244 (76.5)	319	9 (1)	145 (92.4)	157	85 (78.7)	108

Continued

Table 2 Continued

Component	Pooled panel					High-income countries panel					Low/middle-income countries panel				
	Round 1			Round 2		Round 1			Round 2		Round 1			Round 2	
	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N
7.3: surveillance outcomes should be disaggregated by age, sex and gender, geography, socioeconomic status and by the International Classification of Diseases and International Classification of Functioning, Disability and Health systems.	8 (2)	457 (77.1)	593	245 (57.4)	427	8 (2)	327 (75.0)	436	178 (55.8)	319	8 (2)	130 (82.8)	157	67 (62.0)	108
Pillar 8: research and innovation															
8.1: *research priority area 1* - epidemiological and population health research: lifecourse risk factors; risk assessment tools; core outcomes for population health research.	8 (2)	513 (86.5)	593	287 (67.4)	426	8 (2)	368 (84.4)	436	203 (63.8)	318	9 (1)	145 (92.4)	157	84 (77.8)	108
8.2: *research priority area 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.	8 (2)	526 (88.7)	593	288 (67.6)	426	8 (2)	386 (88.5)	436	210 (66.0)	318	9 (2)	140 (89.2)	157	78 (72.2)	108
8.3: *research priority area 3* - health policy and systems research: implementation of MSK service models across contexts; strategies to reduce health inequalities and access inequities; development of a MSK health classification system; effectiveness and acceptability of digital technologies to support MSK care and surveillance.	8 (2)	519 (87.5)	593	272 (63.8)	426	8 (2)	379 (86.9)	436	196 (61.6)	318	8 (1.25)	140 (89.2)	157	76 (70.4)	108
8.4: *research priority area 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-pharmacological interventions.	9 (1)	533 (89.9)	593	325 (76.3)	426	9 (1)	386 (88.5)	436	240 (75.5)	318	9 (1)	147 (93.6)	157	85 (78.7)	108
8.5: *research priority area 5* - health economics research: 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 NCD care; and return on MSK health investment for other sectors such as workforce participation.	9 (1)	549 (92.7)	592	304 (71.4)	426	9 (1)	404 (92.7)	436	226 (71.1)	318	9 (1)	145 (92.9)	156	78 (72.2)	108

Continued

Table 2 Continued

Component	Pooled panel					High-income countries panel					Low/middle-income countries panel				
	Round 1			Round 2		Round 1			Round 2		Round 1			Round 2	
	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N	Median in 1–9 NRS (IQR)	n (%) in median band 7–9	N	N (%) ranked essential	N
8.6: *research capacity priority 1*- support national-level MSK health research; multinational and interdisciplinary research collaborations and lower-resource settings to undertake critical local research.	8 (1)	527 (89.2)	591	292 (68.5)	426	8 (1)	385 (88.3)	436	216 (67.9)	318	9 (1)	142 (91.6)	155	76 (70.4)	108
8.7: *research capacity priority 2* - support co-design of research by people with lived experience of various MSK health conditions and clinicians.	8 (2)	502 (84.9)	591	236 (55.4)	426	8 (2)	368 (84.4)	436	177 (55.7)	318	8 (2)	134 (86.5)	155	59 (54.6)	108
8.8: increase the proportion of research funding allocated to MSK research and allocate additional funding leveraged through public–private partnerships.	8 (1)	523 (88.6)	590	270 (63.4)	426	8 (1)	376 (86.4)	435	194 (61.0)	318	8 (1)	147 (94.8)	155	76 (70.4)	108
8.9: support innovation sharing between countries and between researchers and clinicians.	8 (2)	524 (89.0)	589	290 (68.1)	426	8 (2)	381 (87.8)	434	205 (64.5)	318	9 (1)	143 (92.3)	155	85 (78.7)	108
8.10: support research that harnesses the emerging potential of digital technologies and the collection and use of 'big data' and machine learning.	8 (2)	500 (84.9)	589	236 (55.4)	426	8 (2)	359 (82.7)	434	168 (52.8)	318	9 (1)	141 (91.0)	155	68 (63.0)	108

*Components identified as essential by at least 80% of the panel.
IQR, inter-quartile range; LMIC(s), low- and middle-income country(ies); MSK, musculoskeletal; NCD(s), non-communicable disease(s); n/r, not rated; NRS, Numerical Rating Scale; WHO, World Health Organization.

Summary of essential, globally relevant health systems strengthening actions for MSK health

- Drive engagement and partnerships with: citizens, patients and civil society organisations; industry, workplaces and employers; national and subnational governments.
- Deliver public education across the following sectors: schools and higher education facilities; workplaces; health professionals; and the community, to improve prevention and management of MSK health.
- Foster and support country-level leadership to prioritise MSK health impairment by national governments.
- Extend global and national health and performance indicators beyond mortality reduction to consider function and participation.
- Integrate health promotion and healthcare delivery for MSK health into existing healthcare financing models.
- Ensure service models for MSK conditions support early diagnosis and triage and management through local care pathways.
- Prioritise evidence-based diagnostic and therapeutic practices in service models over approaches that are not supported by evidence, are costly and potentially harmful.
- Identify, resource and provide access to essential therapeutics for priority MSK conditions.

level to strengthen health systems for prevention and management of MSK health.

The policy scoping review identified a large number of national clinical guidelines and reports of national MSK disease burden, but few system-level policies, strategies or action plans were identified. This suggests that while there has been positive progress in articulating burden of disease and clinical management, system-level strengthening is rarely purposively and strategically developed in current policy. We found only three documents that could be considered system-wide strategy or policy for MSK health conditions at the national level[56 79 84] and two at the international level[54 60] and there was very limited policy representation from LMICs. Earlier research identified integration of MSK health into policies for management of NCDs in Member States of the OECD, although the extent of integration varied across countries.[20] In the policy documents we reviewed, there was a consistent focus on the MSK burden of disease, for which the evidence is well developed and strong.[2] Most documents also described broad goals and detailed service delivery and workforce strengthening priorities, with considerably less focus on governance, technologies and information systems. Only a few documents included aspects of monitoring, innovation and community engagement. Collectively, the pool of documents contained a breadth of key issues, themes and principles, although very few existing national policies addressed all the pillars of the logic model and the policy themes we inductively derived. Global health policy development may, therefore, learn from this breadth of many experiences, rather than depth of a few. The scoping review findings also highlight a dearth of MSK health policy among LMICs, which may reflect less developed systems for MSK health in these settings. This presents an opportunity to positively influence the MSK-attributed burden of disease in these countries by providing guidance for policy evolution in healthy ageing, rehabilitation, NCD prevention and control, and road traffic trauma.

The strength of this work lies in the triangulation of several evidence sources to build and validate a data-driven framework of components for a strategic response to improve MSK health globally. The wide sampling frame, inclusion of organisation-level representation and those with lived experience of MSK health impairment ensured a broad range of perspectives were considered in the co-design of the framework. While proportionally more panellists from high-income settings participated in the eDelphi, almost half the countries represented were LMICs. This represents a significant step forward in including perspectives of stakeholders from LMICs than has been achieved previously. Further, no differences in outcomes were identified between panellists in high-income countries and LMICs, apart from more essential components identified by panellists in LMICs. Nonetheless, we acknowledge limited representation from residents of countries in Africa and the Middle East. It will be important to conduct targeted research in these settings to ensure that the components of the proposed framework are acceptable and feasible to stakeholders in these settings. Here, the role of regional offices of the WHO, for example, may be particularly important in facilitating engagement and further co-design and evolution of the components of the framework, and critically, in planning for any implementation. Further research may also be conducted in local languages to facilitate greater involvement from people in LMICs, as their participation may have been limited because the current study was conducted in English only.[99] The modality of data collection may also not have been acceptable to people in LMICs. The nature of the policy scoping review precluded a systematic review, yet we applied systematic search processes to identify the policies. Notwithstanding, we may have missed policies from less populated countries that were not systematically desktop searched, or relevant policy content if contained in documents relating to subnational health policy or captured in adjacent policy fields such as education, injury prevention from violence, road safety, sport and health system regulation.

CONCLUSION

This empirically derived framework of strategic priority areas and detailed components/actions, validated by a contemporary policy scoping review and eDelphi, may be used as a blueprint to develop a

global strategy and action plan on MSK health. Individual countries may also use this as a blueprint to initiate or progress national health system strengthening responses for MSK health. This will be particularly important in LMICs where relatively less policy attention to MSK health has been identified.

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