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'It's about time'. Dissemination and evaluation of a global health systems strengthening roadmap for musculoskeletal health – insights and future directions

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ABSTRACT

Actions towards the health-related Sustainable Development Goal 3.4 typically focus on non-communicable diseases (NCDs) associated with premature mortality, with less emphasis on NCDs associated with disability, such as musculoskeletal conditions—the leading contributor to the global burden of disability. *Can systems strengthening priorities for an underprioritised NCD be codesigned, disseminated and evaluated?* A 'roadmap' for strengthening global health systems for improved musculoskeletal health was launched in 2021. In this practice paper, we outline dissemination efforts for this Roadmap and insights on evaluating its reach, user experience and early adoption. A global network of 22 dissemination partners was established to drive dissemination efforts, focussing on Africa, Asia and Latin America, each supported with a suite of dissemination assets. Within a 6-month evaluation window, 52 Twitter posts were distributed, 2195 visitors from 109 countries accessed the online multilingual Roadmap and 138 downloads of the Roadmap per month were recorded. Among 254 end users who answered a user-experience survey, respondents 'agreed' or 'strongly agreed' the Roadmap was valuable (88.3%), credible (91.2%), useful (90.1%) and usable (85.4%). Most (77.8%) agreed or strongly agreed they would adopt the Roadmap in some way. Collection of real-world adoption case studies allowed unique insights into adoption practices in different contexts, settings and health system levels. Diversity in adoption examples suggests that the Roadmap has value and adoption potential at multiple touchpoints within health systems globally. With resourcing, harnessing an engaged global community and establishing a global network of partners, a systems strengthening tool can be cocreated, disseminated and formatively evaluated.

SUMMARY BOX

- ⇒ In response to musculoskeletal (MSK) health being underprioritised relative to other non-communicable diseases (NCDs), a 'roadmap' for strengthening health systems to improve prevention and control of MSK health impairment was codesigned by the global community and launched in 2021.
- ⇒ A global network of partners supported by resources (particularly multilingual translations of the Roadmap and social media assets) was key to disseminating the Roadmap and ensuring its reach across the target regions of Africa, Asia and Latin America.
- ⇒ Social media analytics and Google Analytics enabled evaluation of geographic reach and stakeholders' interactions with the Roadmap, while collection of user experience measures and real-world adoption case studies provided insights into the value and adoption potential of the Roadmap.
- ⇒ Findings highlight the strong endorsement of the Roadmap as a systems strengthening tool with a clear indication that implementation products and supports are now needed, especially in low-income and middle-income countries.
- ⇒ Investing in non-English translations, establishing a global network of dissemination partners, harnessing analytics potential of social media platforms and Google Analytics, collecting quantitative and qualitative user experiences, and collecting case studies of real-world adoption provide multidimensional insights into how a systems strengthening tool for an underprioritised NCD can be codesigned, disseminated and evaluated in a real-world context.

CONTEXT

In this practice paper, we describe our experiences and insights in developing and disseminating a systems strengthening strategy for musculoskeletal (MSK) health. We describe a formative evaluation of its reach, end-users' perceptions and adoption, interpretation of the evaluation findings and how these

Box 1 Key facts and figures related to the global burden of musculoskeletal (MSK) health impairment

- ⇒ Musculoskeletal conditions consistently feature in the top three conditions contributing to the greatest disability burden across most countries, irrespective of economic development.[1]
- ⇒ The burden of disease related to MSK conditions and transport injuries is increasing more rapidly in low-income and middle-income countries[37] compared with high-income settings.[1 38 39]
- ⇒ A greatest number of people likely to benefit from rehabilitation interventions are those living with MSK conditions, currently estimated at 1.71 billion people.[40]
- ⇒ For the poorest billion people globally, MSK conditions are among the leading health conditions accounting for the majority of disease burden related to non-communicable diseases and injuries.[13]

might inform future directions for systems strengthening efforts. This work is relevant to non-communicable diseases (NCDs) that are afforded a lower priority status (eg, MSK conditions) than those NCDs more closely aligned with the targets of the health-related Sustainable Development Goal (SDG) 3.4.

THE NEED TO ADDRESS THE BURDEN MSK HEALTH IMPAIRMENT

The global burden of MSK impairments

MSK conditions such as low back pain, arthritis and other MSK conditions account for the largest contribution to disability among the NCDs.[1] In the context of injury, most non-fatal injuries affect the MSK system, such as strains and fragility fractures.[2 3] Box 1 outlines key facts and figures related to the global burden of MSK health impairment.

A systems strengthening strategy is needed for MSK health

MSK health is not prioritised in national health plans or policy for NCDs in many countries.[4–9] While there is a myriad of reasons for this, a fundamental reason is the lack of prioritisation globally due to the current SDG 3.4 indicator.[8–10] The indicator positions action towards NCDs associated with premature mortality. This is an appropriate global health goal given the burden of NCDs,[11 12] and a critical target for low-income and middle-income countries (LMICs) in particular, where an increasing contribution of NCDs to the total disease burden has been observed.[1 13] However, the emphasis on premature mortality reduction alone disregards the imperative to concurrently address disability attributed to NCDs and injury, largely driven by MSK impairments. Disability accounts for an increasingly larger proportion of the total disease burden attributed to NCDs and injury.[14] For example, an increasing disability contribution to the total burden of NCDs and injury was observed in all but two countries from 1990 to 2019.[1] Without explicitly addressing the disability contribution to the total burden of disease imposed by NCDs, in particular disability-related to MSK health impairment, a lost opportunity to improve global health will persist.

Box 2 Resources to support organisation-level active dissemination

The following dissemination resources were provided to each organisation:

- ⇒ Briefing document outlining the background to the Roadmap, its relevance to each organisation and an invitation to become a 'dissemination partner'.
- ⇒ YouTube explanatory video link outlining the background to the Roadmap.
- ⇒ Curated and adaptable email templates in seven languages (Arabic, Simplified Chinese, English, Hindi, Brazilian Portuguese, Latin American Spanish and Swahili) inviting individuals to download the Roadmap from the Global Alliance for Musculoskeletal Health (G-MUSC) website in their preferred language and respond to a short survey in their preferred language.
- ⇒ Curated social media packs for three social media platforms, including: Twitter (rebranded to 'X' in July 2023), Facebook and Instagram in seven languages (Arabic, Simplified Chinese, English, Hindi, Brazilian Portuguese, Latin American Spanish and Swahili). Each pack contained text and graphics tailored to the posting requirements of each social media platform (image size and orientation, character limits), directing followers to access the Roadmap from the G-MUSC website in their preferred language and respond to a short survey in their preferred language (figure 1).
- ⇒ Instruction manual about how to post content on social media. Organisations were also encouraged to use other platforms, where this was preferred (eg, LinkedIn, TikTok).
- ⇒ Project officer support to assist with dissemination, where required.

CREATING A ROADMAP TO STRENGTHEN HEALTH SYSTEMS FOR MSK HEALTH

Recognising the gap between the increasing burden of disease attributed to MSK health impairment and policy/systems strengthening responses globally and nationally, the Global Alliance for Musculoskeletal Health (G-MUSC) called for development of a strategy to inform a global response. The call encompassed the prevention and control of MSK conditions, MSK pain, and MSK injury and trauma.

Insights: how to cocreate a systems strengthening response for an overlooked NCD

Experience from the Bone and Joint Decade 2000–2010 suggests that simply stating the size of the MSK burden of disease is insufficient to catalyse system-level change.[15] Therefore, considerable time and effort was invested in planning and deriving a systems strengthening response to ensure it was data driven, codesigned, acceptable, viable and representative of the global community's perspectives. We established an international consortium, supported by G-MUSC, to undertake a phased research programme over 2020–2022. The programme was underpinned by a genuine cocreation approach to derive a roadmap of actions

to strengthen health systems (the 'Roadmap').[10 16 17] A series of projects were undertaken to empirically derive 59 systems strengthening actions organised around eight priority pillars (online supplemental file S1). The research programme included a qualitative study of 31 international key informants from 20 countries (40% LMICs),[8] a content analysis of 41 health policies from 22 countries[6] and a global e-Delphi consisting of 674 panellists from 72 countries (46% LMICs).[10] Recognising the critical importance of understanding context in LMICs,[18] we undertook further work to explore opportunities for systems strengthening in MSK health in LMICs.[4] The cocreators of the Roadmap overwhelmingly agreed or strongly agreed it was valuable and credible (97.6% and 94.8%, respectively; n=426 respondents), irrespective of the economic development of their country of residence, whether they were individuals or organisation-level respondents, or whether they were clinicians or non-clinician respondents.[10]

Insights: approaching dissemination

We approached dissemination of the Roadmap with two key strategies: translation into non-English languages and development of a comprehensive dissemination plan.

1. **Translation**. To support advocacy and health systems strengthening efforts in LMICs in the regions of Africa, Asia and Latin America, the Roadmap was translated into six non-English languages (Arabic, Simplified Chinese, Hindi, Brazilian Portuguese, Latin American Spanish and Swahili) in 2022.
2. **Dissemination plan**. Using the translated Roadmap reports as the dissemination product, a multimodal dissemination plan was developed to maximise reach with specific emphasis on the regions of Africa, Asia and Latin America. These regions were chosen as they represent the largest volume of LMICs. To balance resource limitations with maximising reach into target regions, we engaged with peak global or regional civil society and clinical organisations with reach/membership in the regions of Africa, Asia and Latin America and a scope of interest, activity or influence in MSK health, pain, injury and trauma, rehabilitation or a lifecourse focus (ageing or child and youth). The project team participated in an organisation mapping exercise to identify relevant organisations meeting these criteria, supported by a systematic desktop Internet search, consistent with previous methods (online supplemental file S2).[6 10] We harnessed existing relationships with organisations to initiate engagement or established new connections with organisational leaders. We invited each organisation to become a 'dissemination partner' and supported the invitation with a suite of engagement and dissemination resources (box 2, figure 1).

Figure 1 Examples of Twitter posts in Arabic (A), Simplified Chinese (B), Hindi (C), Brazilian Portuguese (D), Latin American Spanish (E) and Swahili (F).

Table 1 Summary of evaluation questions, methods and outcome measures

Evaluation questions	Evaluation methods	Outcome measures
1. What reach was achieved for the Roadmap reports within the first 6 months of their publication (September 2022 to March 2023)?	Reach was defined and measured in two ways: 1. Reach by dissemination partners: dissemination partners used their existing networks and communication methods to inform their stakeholders about the Roadmap reports. 2. Reach to end users: engagement with the Roadmap reports by end-users was monitored in two ways: – Web traffic to the G-MUSC website where the Roadmap reports were published was monitored using Google's Universal Analytics (Mountain View, CA, USA) tool for the period September 2022 to March 2023. – Access to social media posts by dissemination partners was monitored using analytics functions in Twitter, Facebook and Instagram.	1. *Active reach*: The number of regional/global organisations that agreed and participated as dissemination partners. 2. *Passive reach*: Google Universal Analytics measured visitors to the specific URL where the Roadmap reports were published; whether users were active or inactive on the site (where inactive is defined as a page load only); and the number of reports downloaded. Social media analytic tools (Twitter Analytics, and Facebook and Instagram Insights) measured the number of impressions (the total number of views, including repeat views of posts shared about the reports by dissemination partners) and engagements (the total number of all reactions (clicks, likes, shares, profile views, new followers, post comments, etc) on posts about the Roadmap reports shared by dissemination partners).
► What were the perceptions of value, credibility, usability and utility of the Roadmap among end-users within the first 6 months of publication (September 2022 to March 2023)?	Visitors who accessed the G-MUSC website where the Roadmap reports were published were invited to respond to a brief e-survey powered by Qualtrics (Provo, Utah, USA). The phase 1 survey measured demographic characteristics, their user experience ratings of value, credibility, usability and utility of the roadmap, consistent with dimensions of the Honeycomb User Experience model,[20] and provided the option for free-text comments. Respondents needed to be at least 18 years of age. No other exclusion criteria were applied.	The proportion of respondents who rate the user experience dimensions on a 5-point Likert scale (anchors: strongly agree to strongly disagree). Free-text comments analysed with content analysis.[41]
1. Is there evidence of early adoption of the Roadmap? a. Has the Roadmap been adopted in any way, or is there planned adoption, among end users at 3 months follow-up (June 2023)? b. Are there real-world case studies of early adoption at organisational (meso) and national system (macro) levels?	Respondents to Evaluation Question 1 were contacted 3 months later to evaluate whether they had adopted, or intend to adopt, the Roadmap in any way, using a brief e-survey powered by Qualtrics (Provo, Utah, USA). The phase 2 survey measured adoption, intended adoption and the relative importance of each of the eight pillars. We collected three case studies as examples of early, real-world adoption.	The proportion of respondents who have adopted and intend to adopt, the Roadmap. The relative importance of the eight pillars was measured as the mean rank.

G-MUSC, Global Alliance for Musculoskeletal Health.

EVALUATION OF REACH, PERCEPTIONS AND ADOPTION

Evaluation design

We designed a formative evaluation of (1) dissemination reach, (2) user experience and (3) early adoption over 6 months. The design was anchored to the Reach Effectiveness Adoption Implementation Maintenance (RE-AIM) framework; the most widely used framework for evaluating uptake of public health interventions.[19] Table 1 outlines the evaluation questions, methods and outcomes.

Public and patient involvement

The original Roadmap was codesigned with genuine public and patient involvement from inception and throughout all stages (design through to completion).[10] The current evaluation was cocreated by the project team, with 8 (53%) team members from LMICs. Collecting views of people with lived experience was explicitly included as part of the evaluation design.

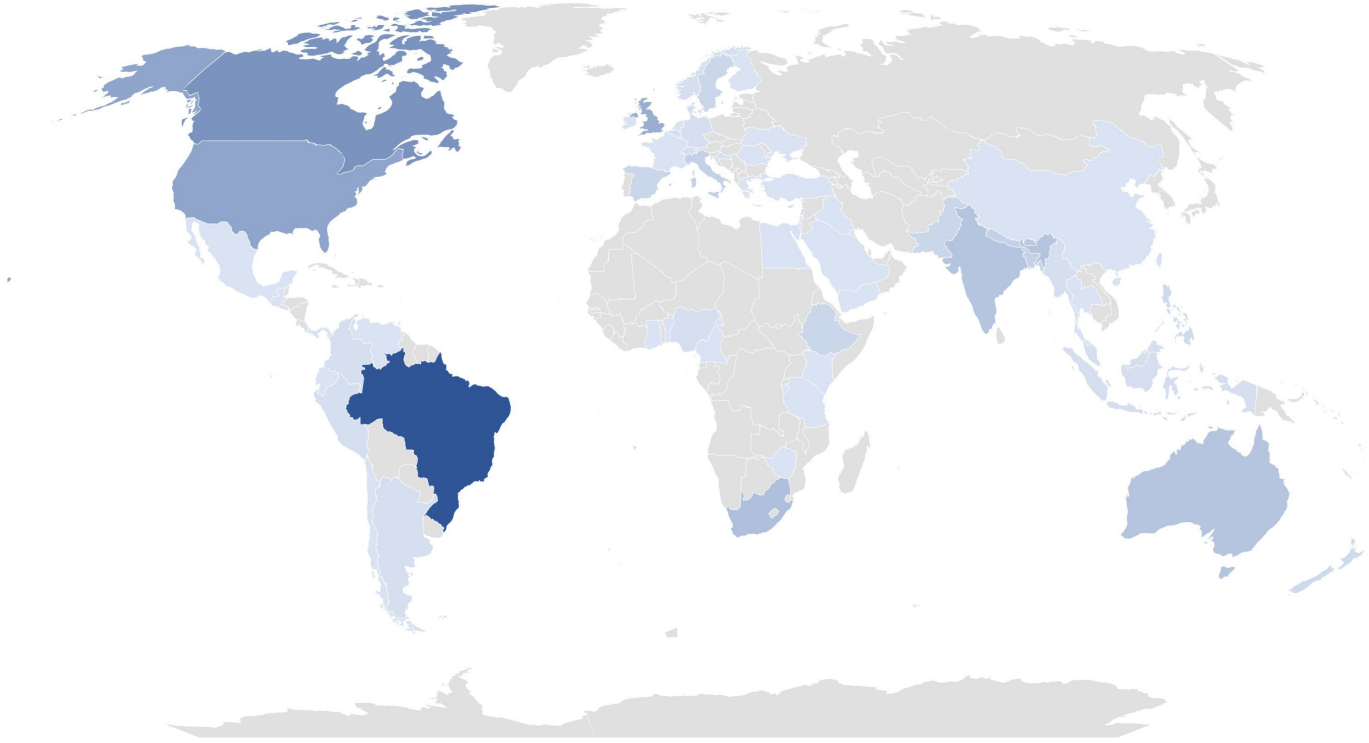

Figure 2 Heat map of total end users (n=2195) across 109 countries over 6 months (September 2022 to March 2023). Darker blue shading reflects a greater frequency of users. Map powered by Microsoft Bing (Microsoft, Redmond, Washington, USA).

EVALUATION QUESTION 1: WHAT REACH WAS ACHIEVED FOR THE SUITE OF ROADMAP REPORTS WITHIN THE FIRST 6 MONTHS OF THEIR PUBLICATION?

Reach by dissemination partners

We identified 42 potential dissemination partners, of which 22 (52%) agreed to support dissemination and 17 (40%) confirmed activities in active dissemination efforts (online supplemental file S3). Dissemination partners predominantly used Twitter (88%) to disseminate the Roadmap (40 unique posts; 12 reposts), with fewer partners using email (71%), Facebook (65%; 19 unique posts; 2 reposts) and Instagram (41%; 12 unique posts; 0 reposts). English was the most commonly language used for posting on Twitter, followed by Arabic, Simplified Chinese and Hindi (online supplemental file S4).

Reach to end users

Over the evaluation period, there were 2195 visitors to the G-MUSC website where the Roadmaps were published (19% repeat visitors) from 109 countries, representing all geographic regions and levels of economic development (41.7% high-income countries (HICs), 25% upper- middle-income countries, 25.9% lower-middle-income countries, 7.4% low-income countries). Comparatively, less reach was observed in Africa and Central Asia (figure 2). Among the visitors, 93% were active on the website (ie, activity beyond a page load), including 829 downloads (138/month) of a Roadmap report (69.2% English, 13.6% Latin American Spanish, 12.9% Brazilian Portuguese, 1.6% Simplified Chinese, 1.5% Arabic, 1.0% Swahili and 0.2% Hindi). We restricted reach evaluation to Twitter, since it was the most used social media platform. The highest median count of impressions and engagements with Twitter posts across organisations were recorded for posts in Brazilian Portuguese (n=1608 impressions) and English (n=21 engagements). Across all languages, mean impressions per day were at least 5 (range 1–157) while mean engagements per day exceeded 1 (range 1–7) for English and Hindi only (online supplemental file S4).

EVALUATION QUESTION 2: WHAT WAS THE USER EXPERIENCE OF THE ROADMAP WITHIN THE FIRST 6 MONTHS OF PUBLICATION?

Among 373 unique respondents, 254 (68%) provided at least one valid data point for the phase 1 user experience survey. Demographic characteristics are summarised in table 2.

Respondents predominantly represented health workers, educators/researchers and people with lived experience. We collected responses from people across 63 countries representing all geographic regions. More than 50% of respondents represented the target regions of Africa, Asia and Latin America. Further, more than 50% of the countries represented and respondents were in the low-income or middle-income economic classification. Across the four user experience domains,[20] respondents 'agreed' or 'strongly agreed' the Roadmap was valuable (88.3%),

Table 2 Demographic characteristics of survey respondents in phase 1 (n=209) and phase 2 (n=89)

Characteristic	Phase 1		Phase 2	
Age band (years)*				
18–35	49 (19.3)		19 (21.3)	
36–50	93 (36.6)		23 (25.8)	
51–65	73 (28.7)		37 (41.6)	
66–80	38 (15.0)		9 (10.1)	
>80	1 (0.4)		1 (1.1)	
Gender				
Man	127 (60.8)		53 (59.6)	
Woman	77 (36.8)		36 (40.4)	
Prefer to self-describe	1 (0.5)		0	
Prefer not to answer	4 (1.9)		0	
Respondent category†				
Patient or person with lived experience of a musculoskeletal condition/ rheumatic disease	40 (19.1)		14 (15.7)	
Patient or person with lived experience of a long-term health condition, other than a musculoskeletal condition/rheumatic disease	20 (9.6)		6 (6.7)	
Health professional (medical officer, nurse, allied health worker, other registered clinician, other health worker)	166 (79.4)		71 (79.8)	
Educator or researcher	98 (46.9)		48 (53.9)	
Officer of a national or sub-national government ministry	8 (3.8)		1 (1.1)	
Officer of a local municipality (local government)	6 (2.9)		1 (1.1)	
Officer of a Civil Society Organisation or other professional organisation/ clinical organisation	23 (11.0)		15 (16.9)	
Other	8 (3.8)		5 (5.6)	
Responses by geographical region	Countries	Respondents	Countries	Respondents
East Asia and Pacific	11 (17.5)	26 (12.4)	9 (22.5)	14 (15.7)
Europe and Central Asia	18 (28.6)	45 (21.5)	12 (30.0)	24 (27.0)
Latin America and Caribbean	10 (15.9)	45 (21.5)	5 (12.5)	11 (12.4)
Middle East and North Africa	7 (11.1)	9 (4.3)	2 (5.0)	2 (2.2)
North America	2 (3.2)	33 (15.8)	2 (5.0)	18 (20.2)
South Asia	5 (7.9)	29 (13.9)	5 (12.5)	13 (14.6)
Sub-Saharan Africa	10 (15.9)	22 (10.5)	5 (12.54)	7 (7.9)
Responses by economic classification	Countries	Respondents‡	Countries	Respondents
High income	28 (45.2)	96 (46.2)	17 (42.5)	48 (53.9)
Upper-middle income	12 (19.4)	56 (26.9)	10 (25.0)	16 (18.0)
Lower-middle income	19 (30.6)	50 (24.0)	12 (30.0)	22 (24.7)
Low income	3 (4.8)	6 (2.9)	1 (2.5)	3 (3.4)

Data are expressed as n (%). In phase 1, the denominator is 209, unless otherwise indicated
*N=254
†Respondents could select more than one category.
‡Economic classification based on World Bank 2023 fiscal year. N=208 since Venezuela does not have an economic classification by the World Bank.

credible (91.2%), useful (90.1%) and usable (85.4%) (figure 3). Most (77.8%) agreed or strongly agreed they would adopt the Roadmap in some way. A significantly larger proportion of respondents from LMICs (84%) agreed or strongly agreed they would adopt or use the Roadmap in some way, compared with respondents from HICs (70%). Among the 61 free-text comments received, the main themes related to:

- Identification of the Roadmap as a valued tool for health systems strengthening: '*All I can say is: 'It's about time' we see NCD and MSK concerns taking the centre field with the WHO and many National and* non-government organisations (*NGO) organizations interested in more cost-effective and outcome-based results in MSK care'.*
- Need to transition to implementation support, particularly for influencing priorities for national

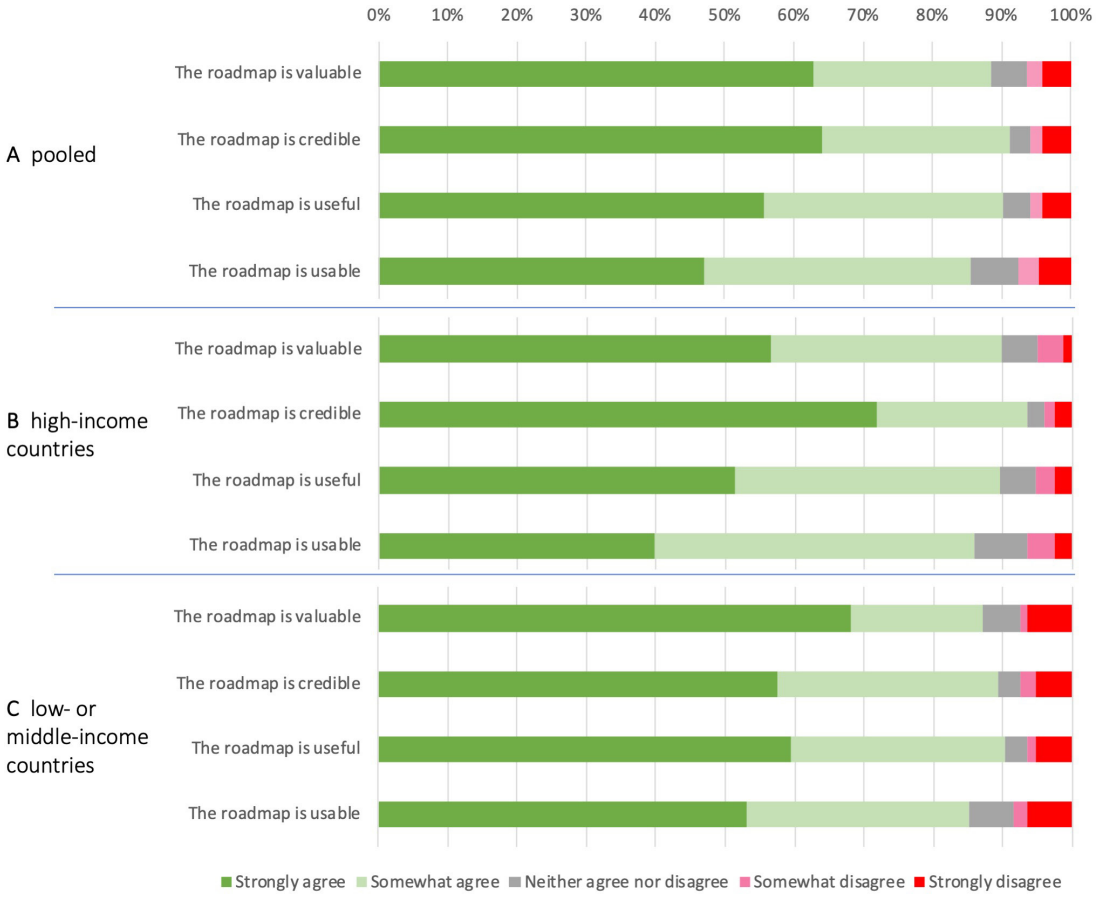

Figure 3 Judgements by respondents related to the user experience dimensions of value, credibility, usefulness and usability of the Roadmap, presented as pooled cohort proportions (A, n=171) and by respondents from high-income countries (B, n=77) and low-income or middle-income countries (C, n=94).

health: '*How the strategies and blueprint developed could be practically incorporated will be of value.*'

- Need for adaptation and support in LMICs where MSK health is not a priority condition: '*This report is very important. But there is no money in Africa to implement this report. … There is practically no funding for musculoskeletal research, education or advocacy in Africa. Musculoskeletal diseases are foreign language to the African government[s] and health authorities. Musculoskeletal NGOs in Africa are left by donors to bark like toothless dogs'.*

See online supplemental file S5 for more detail on content analysis of the free-text outcomes.

EVALUATION QUESTION 3: IS THERE ANY EVIDENCE OF EARLY ADOPTION OF THE ROADMAP?

Eighty-nine individuals responded to the phase 2 follow-up survey in June 2023 (table 2). Forty-one (46.1%) indicated they had adopted the Roadmap in some way, with no differences observed between respondents in HICs compared with LMICs. Respondents reported they shared it with other people/organisations (70.7%), discussed it with other people/organisations (63.4%) and referred to/promoted it in reports or presentations (51.2%). Seventy-four (83.1%) indicated their intention to use the Roadmap in some way. Although not statistically significant, a larger proportion of respondents from LMICs (92.5%) indicated planned adoption, compared with respondents from HICs (78.7%). Respondents intended to share the Roadmap with other people/organisations (71.6%), discuss it with other people/organisations (68.9%) and refer to/promote it in reports or presentations (64.9%). Considering the importance of the eight pillars, mean rank was highest for Pillar 1 (Engaging, empowering and educating communities), followed by Pillar 2 (Leadership, governance and shared accountability) and Pillar 4 (Service delivery), with the lowest rank assigned to Pillar 7 (Population health surveillance). Mean ranks of these pillars were consistent across respondents from HICs and LMICs (online supplemental file S6). Translations were judged to be very or highly useful by 44.6% of respondents.

We identified three examples of early adoption of the Roadmap. Two included adoption by organisations with a global reach, where the Roadmap had informed organisation-level strategic planning (box 3). The third case describes adoption context within a lower-middle-income country with plans for national-level adoption (box 4).

Box 3 Adoption case studies 1 and 2—global organisation-level adoption

Case 1

Following publication of the Roadmap, World Physiotherapy (WP) and the manual/musculoskeletal group of WP (The International Federation of Orthopaedic Manipulative Physical Therapists—IFOMPT) reviewed the actions underpinning the eight pillars. WP and IFOMPT considered: (1) how their current portfolio of activities supported the pillars; (2) what further activities WP and IFOMPT need to consider to support implementation of the Roadmap; and (3) how such activities could be achieved by two global organisations made up of national professional organisations. A recent editorial outlines the organisations' actions against pillar 1 ('Engaging, empowering and educating communities').[42] Pillar 1 was chosen as the 'test case' for strategic mapping since it was considered to be closely aligned to the purpose of both organisations and it contains the greatest number of essential actions.

Case 2

The International Federation of Musculoskeletal Research Societies (IFMRS) is an umbrella organisation of MSK research societies. The IFMRS launched its Education in Musculoskeletal Research Global Action Plan in March 2023, which provides a framework for tackling some of the biggest challenges facing the MSK community and captures key recommendations relevant to all sectors of the global MSK community. The Action Plan is the result of several virtual round tables and discussions over 2 years, involving a wide range of stakeholders from all parts of the MSK community globally. The Roadmap provided a powerful point of reference to inform these discussions, in particular Pillar 8 ('Research and innovation'). Adoption of the Roadmap enabled the IFMRS to anchor its vision and recommendations and underlined how the solutions proposed around research and education are part of a much broader suite of necessary system reform actions for improving MSK health globally.

Box 4 Adoption case study 3—Organisation-level adoption with planned national system-level adoption

Pakistan is a densely populated (>240 million people) lower-middle-income nation with low healthcare expenditure (US$38 per capita in 2020) relative to gross domestic product (GDP) (2.95% of GDP).[43] Historically, MSK health has not been a public health priority in Pakistan. In 1996 for a population 137 million, the MSK workforce comprised only of eight rheumatologists. Advocacy for increasing the prioritisation of MSK health and building capacity in the rheumatology workforce was augmented when the Arthritis Care Foundation (ACF) was established in 2010.

Working collaboratively with the national and subnational government and rheumatology experts, ACF adopted actions under select pillars of the Roadmap to inform its future strategic priorities. Specifically, the ACF has undertaken and will continue to undertake activities related to public awareness (Pillar 1), engagement with government and supporting national leadership activities (Pillar 2), facilitating service delivery (Pillar 4), contributing towards provision of essential diagnostics and therapies (Pillar 5) and engaging in workforce training (Pillar 6). To further support national adoption, ACF is working closely with national academia and the WHO country office to elevate the priority of MSK health and initiate planning for national systems strengthening activities in Pakistan. Specifically, an expert advisory group is being established to elevate MSK health to a national priority agenda. This will inform development of a national strategy to improve MSK health for Pakistan.

INTERPRETATION

What did we find?

The evaluation highlighted a wide geographic reach, high levels of acceptability and support, and promising early adoption of the Roadmap, irrespective of national economic development. Importantly, the evaluation sample represented all geographic regions and levels of economic development. We interpret, therefore, that the codesigned pillars and actions described in the Roadmap have global applicability. This helps position the Roadmap as a viable health systems strengthening response for MSK health globally. Findings highlight that as adoption activities extend, there is a need to focus efforts towards implementation support, particularly in LMICs where resources are limited, and the priority status of MSK health is typically low.[4] This transitional approach from strategy development to implementation support also aligns with the evolution of other health systems strengthening initiatives, such as the WHO Integrated Care for Older People (ICOPE) approach and the WHO Rehabilitation 2030 initiative.[21 22]

Notably, respondents from LMICs expressed a stronger intention for adoption than respondents from HICs in phase 1, which may suggest a stronger appetite for an MSK-focused health systems strengthening response in LMICs. This also resonates with findings at the cocreation stage of the Roadmap, where more of the codesigned actions were deemed essential for health systems in LMICs, compared with HICs.[10] In phase 2, we observed some self-reported early adoption among stakeholders and strong future adoption intentions, with a signal of greater adoption intent from respondents from LMICs. This is unsurprising in light of evidence for limited system-level responses to the burden of MSK impairments among LMICs.[4 6 23 24]

Across all economies, respondents expressed the highest importance for health systems strengthening actions related to public health and community awareness of MSK health (Pillar 1); policy responses relevant to MSK health (Pillar 2) and accessible health services for people with MSK health conditions (Pillar 4). These priorities resonate with what is commonly observed across communities and health systems: a lack of understanding of, and recognition for, the burden of MSK health impairments; inadequate or absent policy responses; and inequitable access to high-value health services for people living with MSK health impairments.[8 24–26] The relative deprioritisation of population health surveillance (Pillar 7) is understandable on a background of a history of limited system-level (macro) and service-level (meso) reform activities for MSK health in most countries. This may necessitate more urgent attention to pillars of the Roadmap that target community perceptions, policy responses and service delivery, consistent with findings from aligned research.[24] Nonetheless, the lower priority

assigned to population health surveillance may limit action on other pillars. Without population health data on prevalence and burden, local advocacy and data-driven policy responses become less achievable—the problem of '*no data*' inferring '*no disease*'. Indeed, aligned research has identified a lack of national-level population health surveys for MSK conditions and global health estimates for MSK conditions lack primary data for many nations, in particular from LMICs.[27–29]

Insights

We invested resource into the dissemination strategy anchored to a partnership model, on the premise that the potential reach using a global network of dissemination partners would be superior to what the project team could achieve alone. We also adopted this model with the intention to build awareness, genuine engagement and promotion among the network of dissemination partners. We interpret that the creation of bespoke dissemination assets (box 2) was a key factor to successful engagement with dissemination partners and ultimately to reaching end users. More than half of the evaluation sample represented the key regions we targeted—Africa, Asia and Latin America—suggesting the multifaceted dissemination plan was effective and could continue to be used for similar dissemination efforts.

Using Google Analytics and Twitter Analytics tools enabled tracking of end user interactions with the Roadmap; data we considered critical to evaluate reach and user engagement. Twitter was the most widely used platform to disseminate information about the Roadmap, consistent with observations around the choice of social media platforms for disseminating health information,[30] and the platform of choice by global health agencies such as the WHO. Recent research suggests that the construction of tweets about global health information influences their diffusion.[31] This highlights the importance of attention to tweet construction attributes in future dissemination initiatives, and the important role of partnering with health communication experts.

The collection of case studies allowed unique insight into early adoption practices in different contexts, settings and health system levels. The diversity in adoption examples suggests that the Roadmap has value and adoption potential at multiple touch points within health systems. We infer that it may contribute to systems strengthening responses in different ways; in our examples, from informing organisational strategic directions on MSK health, to building workforce capacity, to service delivery and to national policy response, among others.[24 32] The collection of case studies also allows for deeper insights into adoption practices and sharing of experiences. This approach, commonly used for health systems strengthening evaluations,[24 33 34] provides context that would not be ascertainable from survey methods.

Lessons and future directions

Although we observed wide reach and end user interaction with the Roadmap, we cannot speculate on the nature of these interactions and broader perceptions owing to the limited available metrics. Further, the sample that participated in the survey phases was modest, especially in phase 2 where the response rate was low, and therefore, the findings may not be generalisable. One interpretation here is that end users were interested in receiving information about the Roadmap and accessing it, but not interested in participating in further evaluation.

A key challenge in sampling was recruitment of participants outside health professionals, educators and researchers. We observed over-representation from these sectors which may reflect the stakeholder networks of our dissemination partners, yet we did reach people with lived experience (19%) at a proportion comparable to an earlier review.[35] In future evaluation cycles, targeting a more diverse sample, including a sample outside the MSK sector, will be important. A critical future direction in evaluation, and ultimately implementation, will be to understand the integration potential of the Roadmap with systems strengthening initiatives for other NCDs, especially among policy-makers, service managers and other civil society organisations.

CONCLUSIONS

The Roadmap builds on decades of advocacy since the Bone and Joint Decade to elevate the priority status of MSK health within the global health agenda. The Roadmap is the first globally focused and cocreated product that outlines acceptable and feasible actions in systems strengthening. Nonetheless, we predict that raising awareness and supporting adoption and implementation will remain challenging, since in many HICs,[5] most LMICs,[4 23] and globally,[7 8] MSK health has not been a health priority area. Recent global responses from the WHO, such as the Rehabilitation 2030 products and ICOPE,[22 36] position MSK health with a higher priority, creating a unique window of opportunity for accelerating health systems strengthening responses—an area where the Roadmap can meaningfully contribute.

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Contributors AMB, JC, MC, SAH, AAK, LM, SSharma, ERS and HS conceived and designed the evaluation AMB, JC, MC, FJJS and HS led the data collection NMA, LF, FM, SSarfraz contributed data AMB, JC and MC led data analysis AMB drafted the manuscript. All authors contributed to revising the manuscript and approved the final version for submission.

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Competing interests AMB reports grant income from AO Alliance, Asia Pacific League of Associations for Rheumatology, Australian Rheumatology Association, Curtin University, Pan American League of Associations for Rheumatology, and World Federation of Chiropractic related to the current work. AMB reports grant funding from the Australian Government, Department of Health; Medical Research Future Fund (Australian National Health and Medical Research Council); Western Australian Government Department of Health; Bone and Joint Decade Foundation; Curtin University; Institute for Bone and Joint Research (Australia); Canadian Memorial Chiropractic College; and Arthritis and Osteoporosis Western Australia outside the submitted work. AMB reports consultancy fees and travel support from the WHO and speaker fees from the American College of Rheumatology outside the current work. JC: reports personal income from Curtin University related to the current work. MC: reports institutional income from the Bone and Joint Decade Foundation related to the current work; and Royalties from Up-to-Date unrelated the current work. NMA: nothing to disclose. LF: reports leadership roles with World Physiotherapy and the International Federation of orthopaedic Manipulative Physical Therapists. SAH: nothing to disclose. MJ: reports a leadership role with AO Alliance and personal fees. AAK: nothing to disclose. LM: reports institutional income from the Bone and Joint Decade Foundation related to the current work. LM reports grant income from Janssen Australia, NHMRC Australian Government CREE for Inflammatory Arthritis, MRFF Australian Government Adult Arthritis Biologic Tapering Trial, and MRFF Australian Government Juvenile Arthritis Biologic Tapering Trial outside the current work. LM reports data safety monitoring (unpaid) on an Australian Government funded trial for opioid medicines. LM reports leadership positions with the Global Alliance for Musculoskeletal Health and the Australian Rheumatology Association. FM: reports a leadership position with the International Federation of Musculoskeletal Research Societies. FR: nothing to disclose. SSarfraz: nothing to disclose. SSharma: reports fellowship funding from the International Association for the Study of Pain (IASP) and speaker fees and travel support from the IASP unrelated to the current work. SSharma reports leadership positions with the IASP. ERS: reports income from PANLAR, Abbvie, Elea and Pfizer outside the current work; testimony fees from Abbvie, Amgen, BMS, Glaxo, Janssen, Lilly, Novartis, Pfizer, Sandoz, UCB; and support for attening meetings from Abbvie, Janssen, Pfizer, UCB, Amgen. HS: reports grant income from AO Alliance, Asia Pacific League of Associations for Rheumatology, Australian Rheumatology Association, Curtin University, Pan American League of Associations for Rheumatology, and World Federation of Chiropractic related to the current work. HS reports grant funding from the Australian Government, Department of Health; Medical Research Future Fund (Australian National Health and Medical Research Council); Western Australian Government Department of Health; Bone and Joint Decade Foundation; Curtin University; Institute for Bone and Joint Research (Australia); and Canadian Memorial Chiropractic College outside the submitted work. HS reports travel support from the Australian Pain Society to attend a scientific meeting.

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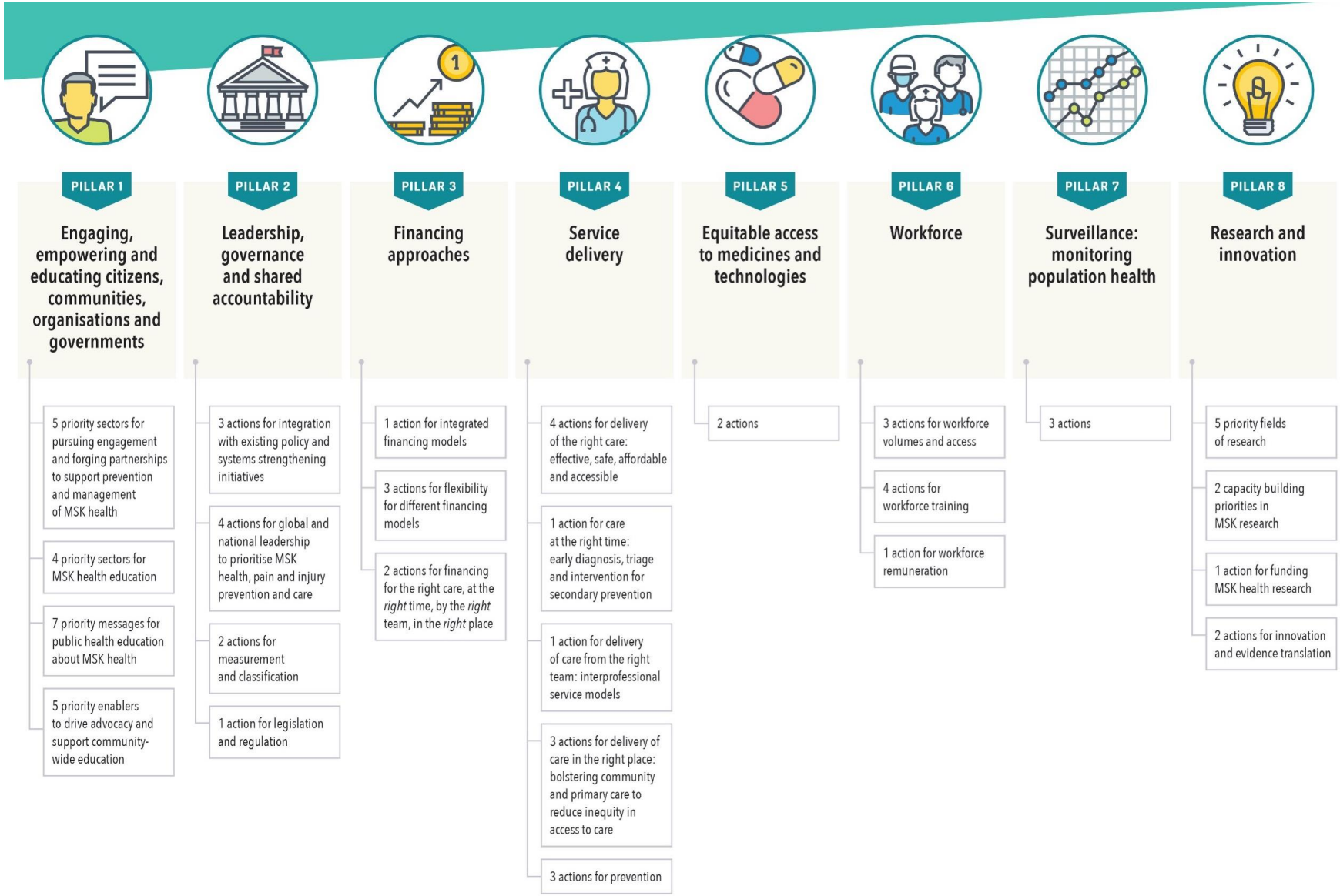
Supplementary file

Table of Contents



File S1: Figure 1. Overview of the 8 priority pillars to strengthen health systems for improved prevention and management of musculoskeletal (MSK) health. Reproduced from Briggs et al (https://doi.org/10.1016/j.semarthrit.2022.152147) under licence agreement 5587490812227 with Elsevier.

File S2: Systematic internet search

A systematic search for regional organisations representing either the regions of Africa, Asia, Asia-Pacific, Latin America or global organisations was performed using Google (Mountain View, CA, USA) from 4 July 2022 to 27 July 2022 (Box 1). Snowball searches were also conducted by searching within the websites of identified organisations.

Box 1. Keyword search strategy used to identify global and/or regional professional organisations

Chiropractic
Chiropractor/ic + society + Region name (or global/international)
Chiropractor/ic + Association + Region name (or global/international)
All of the above + Region name (or global/international)

Gerontology/Geriatrics
Geriatrics + Society+ Region name (or global/international)
Gerontology + Association + Society + Region name (or global/international)
All of the above + Region name (or global/international)

Occupational Therapy
Occupational Therapy + society + Region name (or global/international)
Occupational Therapy + Association + Region name (or global/international)
All of the above + Region name (or global/international)

Orthopaedics
Orthopaedics + Association + Society + Region name (or global/international)
Orthopaedics Specialist + Association + Society + Region name (or global/international)
All of the above + Region name (or global/international)

Pain Medicine
Pain + Association + Society + Region name (or global/international)
Pain + Chapters + IASP + Region name (or global/international)
Anaesthesiology + Pain + Region name (or global/international)
All of the above + Region name (or global/international)

Paediatrics/Adolescent health
Paediatrics + Association + Region name (or global/international)
Paediatrics + Society + Region name (or global/international)
All of the above + Region name (or global/international)

Physiotherapy
Physio/Physiotherapy + Association + Region name (or global/international)
Physio/Physiotherapy + Society + Region name (or global/international)
Physical Therapy + Association + Region name (or global/international)
Physical Therapy + Society + Region name (or global/international)
All of the above + Region name (or global/international)

Rehabilitation
Rehab + Rehabilitation + Association + Region name (or global/international)

Rehab + Rehabilitation + Society + Region name (or global/international)
All of the above + Region name

Rheumatology
Rheumatology + Association + Society + Region name (or global/international)
Rheumatism + Association + Society + Region name (or global/international)
Arthritis + Association + Society + Region name (or global/international)
Musculoskeletal + Association + Society + Region name (or global/international)
All of the above + region name

File S3: Active dissemination partners

Active dissemination partner organisations^	**Region**
Asia Pacific Research Network on Ageing (APPRA)	Regional (Asia-Pacific)
Academic Consortium for Integrative Medicine & Health	Global
African League Against Rheumatism (AFLAR)	Regional (Africa)
AO Alliance Foundation	Regional (Sub-Saharan Africa and Asia)
Arab League of Associations for Rheumatology (ArLAR)	Regional (Middle East)
Asia Pacific League of Associations for Rheumatology (APLAR)	Regional (Asia-Pacific)
Global Alliance for Musculoskeletal Health (GMUSC)	Global
International Association for the Study of Pain (IASP)	Global
IASP Global Alliance of Partners for Pain Advocacy Presidential Task Force	Global
International Federation of Musculoskeletal Research Societies (IFMRS)	Global
International Federation of Orthopaedic Manipulative Physical Therapists Incorporated (IFOMPT)	Global
International Society of Physical and Rehabilitation Medicine (ISPRM)	Global
Paediatric Taskforce, Global Alliance for Musculoskeletal Health	Global
Pan American League of Associations for Rheumatology (PANLAR)	Global
Société Internationale de Chirurgie Orthopédique et de Traumatologie (SICOT)	Global
World Federation of Chiropractic (WFC)	Global
World Physiotherapy and it's regional chapters (Africa, South America, Asia)	Global / Regional (Africa, South America, Asia)

^ an additional 5 dissemination partners were identified, however, these partners did not provide evidence of active dissemination activities.

File S4: Social media analytics data by platform and language

Social media platform	Language						
	Arabic	Brazilian Portuguese	English	Simplified Chinese	Hindi	Latin American Spanish	Swahili
TWITTER							
Total number of posts across organisations[a] (Number of reposts)[b]	5 (0)	1 (0)	21 (4)	4 (2)	4 (2)	3 (2)	2 (2)
Analytic time window in median days (min-max)[c]	114 (32 – 140)	153 (153–153)	105 (13 – 188)	75 (20 – 145)	76 (13 – 147)	13 (9 – 13)	119 (105 – 132)
[Number of organisations]	[4]	[1]	[15]	[4]	[4]	[3]	[2]
Median (min-max) number of **impressions** across all posts[d]	524 (149 – 570)	1608 (1608–1608)	490 (87 – 2530)	525 (405 – 1068)	519 (252 – 806)	499 (107 – 589)	641 (188 – 1093)
[Number of organisations]	[4]	[1]	[15]	[4]	[4]	[3]	[2]
Mean (SD), min-max, number of **impressions** per day[d]	6.4 (6.3), 1.4 – 15.7,	10.5 (0), -	23 (40.8), 0.8 – 156.6,	13.3 (10.7), 4.0 – 28.3,	18.1 (25.6), 2.5 – 56.3,	20.1 (22.3), 3.2 – 45.3,	5 (4.6), 1.8 – 8.3,
[Number of organisations]	[4]	[1]	[15]	[4]	[4]	[3]	[2]
Median (min-max) number of **engagements** across all posts[e]	11 (7 – 19)	30 -	21.5 (2 – 107)	14 (6 – 21)	10 (6 – 13)	10 -	13 (12 – 14)
[Number of organisations]	[3]	[1]	[12]	[2]	[2]	[1]	[2]
Mean (SD), min-max, number of **engagements** per day[e]	0.1 (0.04) 0.06 – 0.10	0.2 (0) -	4.4 (2.1) 0.7 – 7.3	0.1 (0.1) 0.05 – 0.1	1.4 (0.01) 2.37 – 2.38	0.1 (0) -	0.1 (0.03) 0.09 – 0.1
[Number of organisations]	[3]	[1]	[12]	[2]	[2]	[1]	[2]
FACEBOOK							
Total number of posts across organisations[a] (Number of reposts) [b]	2 (0)	1 (0)	13 (2)	1 (0)	0 (0)	1 (0)	1 (0)
INSTAGRAM							

Total number of posts across organisations[a] (Number of reposts)[b]	2 (0)	0 (0)	7 (0)	1 (0)	1 (0)	0 (0)	1 (0)

a. Total number of posts across organisations: Represents the total number of posts (including re-posts) about the roadmap.
b. Number of reposts: The number of times a post about the roadmap was reposted, regardless of whether it was a new post or a repost of an earlier post by the same organisation or another organisation.
c. Analytic time window: the period (days) between when the social media data (impressions/engagements) were retrieved from the social media platform and the date that the same post was posted.
d. Impressions: Count of the total number of times a user views the roadmap post in their timeline or search results
e. Engagements: Count of the total number of times a user interacted with a post. Clicks anywhere on the post, including reposts, replies, follows, likes, links, embedded media, username, profile photo, or post expansion.

File S5: Themes identified from qualitative content analysis of free text comments from the phase 1 survey (n=61)^.

Theme	Description	Exemplar quote(s)[#]
1	The Roadmap needs to more clearly identify the role of interprofessional practice to improve MSK health.	*"Inter-professional linkages could have been stressed more."*
2	There is a need to consider the unique context in LMICs, where MSK health is not a priority health condition, especially among the African countries. Within these settings, adaptation of the Roadmap and support for implementation (especially financing) will be needed.	*"This report is very important. But there is no money in Africa to implement this report. This [MSK health] is a developed country affair. There is practically no funding for musculoskeletal research, education or advocacy in Africa. Musculoskeletal diseases are foreign language to the African government and health authorities. Musculoskeletal NGO's in Africa are left by donors to bark like toothless dogs."* *"The reports are very informative. However most middle-income countries may need to adjust it to fit in their context due to lack of infrastructure and health systems."*
3	There is now a need to transition to implementation support, since there are ongoing challenges with implementation, especially in regard to influencing the awareness and priorities of national or local governments.	*"How the strategies and blueprint developed could be practically incorporated will be of value."* *"I am the person in charge of the Healthy Back Program of the Municipal government, where I live and work professionally, the report has been very useful, but it happens that when trying to apply certain strategies, especially referring to public policies in prevention of musculoskeletal health in the community, I do not find reception, and interest in the governments of the day. It seems that I cannot place the issue of the importance of musculoskeletal health in the discussion of important issues of public health policy."*
4	The Roadmap is a valuable tool for health systems strengthening in MSK health.	*"All I can say is: "It's about time" we see NCD and MSK concerns taking the center field with the WHO and many National and NGO organizations interested in more cost-effective and outcome-based results in MSK care. This is very important work and I can leverage this project into several Public Health and Community service actionable."* *"These reports are a valued and welcomed addition to the body of evidence surrounding the care and management of musculoskeletal disorders. As the world recognises the shift in emphasis from communicable to non-communicable diseases, reports of this nature will have an increasing impact on health policy and investment from nations, particularly in low- and middle-income countries."*

5	Across the Roadmap and within implementation planning, greater consideration of the importance of sex and gender to MSK health is needed.	*"The outlined plan will help guide the future for global MSK care. However, additional integration of the impacts of sex and gender throughout the document may raise awareness of the need to better understand how the outcomes (including pain) of prevention and intervention efforts may vary based on a patient's sex or gender. The resulting information will allow us to provide improved patient-centered care."*

^ free text comments that were unrelated to the Roadmap were not analysed
# responses written in languages other than English were translated to English for analysis.

File S6: Mean (SD) rank of importance for each of the 8 Pillars of the Roadmap, presented as pooled mean ranks and disaggregated by income band.

Pillar	Pooled mean (SD); n=75	HICs mean (SD); n=43	LMICs mean (SD); n=32
Pillar 1: Engaging, empowering and educating communities	2.5 (1.7)	2.4 (1.7)	2.6 (1.7)
Pillar 2: Leadership, governance and shared accountability	3.0 (1.8)	2.9 (1.7)	3.1 (1.9)
Pillar 3: Financing approaches	4.7 (2.0)	4.88 (2.0)	4.3 (2.0)
Pillar 4: Service delivery	3.9 (1.8)	3.7 (1.5)	4.1 (2.0)
Pillar 5: Equitable access to medicines and technologies	4.8 (1.8)	4.91 (1.8)	4.7 (1.7)
Pillar 6: Workforce	5.2 (2.0)	5.4 (2.1)	5.0 (1.9)
Pillar 7: Surveillance: monitoring population health	6.7 (1.8)	7.0 (1.5)	6.3 (2.1)
Pillar 8: Research and innovation	5.3 (2.4)	4.86 (2.4)	5.9 (2.4)

HICs: respondents from high-income countries
LMICs: respondents from low- and middle-income countries