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Temporal and spatial distribution of musculoskeletal disorders from 1990 to 2019: a systematic analysis of the global burden of disease

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ABSTRACT

Objectives This study aimed to globally assess the prevalence and distribution of primary-origin musculoskeletal disorders (MSDs) from 1990 to 2019 to better understand their temporal trends.

Methods Using data from the 2019 Global Burden of Diseases, prevalence rates of six primary-origin MSDs were analysed across subregions, age groups and genders. Raw and age-standardised prevalence were mapped for over 204 countries. Cochran-Armitage trend tests evaluated temporal prevalence trends. The correlation between MSDs prevalence, national income levels and medical density was explored.

Results In 2019, global MSDs prevalence varied significantly among countries. Hip osteoarthritis had a prevalence of 0.56% (95% CI: 0.43% to 0.70%), while low back pain was 8.62% (95% CI: 7.62% to 9.74%). Most MSDs exhibited an increasing prevalence with age, except for neck pain, which stabilised or decreased after age 45–50. Women generally had higher prevalence rates across all age groups. High-income countries consistently showed higher prevalence rates compared with middle and low-income countries. Over time, most subregions experienced a significant increase in MSD prevalence. However, after adjusting for age, the temporal trends for back and neck pain became non-significant, except for hip osteoarthritis, where half of the subregions remained significant. Multiple linear regressions revealed positive correlation between MSD prevalence and both national income level and medical density.

Conclusion The global burden of MSDs is increasing due to population ageing, but other factors should be considered. Longitudinal studies with a wider range of MSDs and additional risk factors are needed for improved prevention strategies.

INTRODUCTION

Musculoskeletal disorders (MSD) are among the most common conditions worldwide, affecting 1.71 billion people in 2020. MSD includes approximately 150 distinct conditions and can affect people's quality of life, healthcare costs and work efficiency.¹ Beyond

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Musculoskeletal disorders (MSDs) constitute a significant global health challenge. Despite many known risk factors, data on their temporal trends and geographical distribution are lacking.

WHAT THIS STUDY ADDS

⇒ Our study describes the spatio-temporal distribution of MSDs, indicating an increasing burden over the last three decades. Low back pain systematically appears to be the most widespread, regardless of time or place. After adjusting for age, the temporal trends for back and neck pain became non-significant, except for hip osteoarthritis. A clear difference in prevalence between the Global North and South appears, which is not solely attributed to age differences, but is probably predominantly explainable by under-reporting from low-income countries.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The results highlight the need for comprehensive surveillance with longitudinal monitoring of MSDs with the aim of having a better understanding of their latencies and a more in-depth exploration of global disparities. This knowledge can inform future prevention efforts and policy development.

health issues, MSD may generate considerable productivity loss. In 2010, it was estimated that 39.2% of European workers suffered from chronic pain and could not work to their total capacity.² Despite the widespread perception of a Northern country-specific issue, MSD represents a global health concern. In 2016, the Global Burden of Disease (GBD) estimated that low back pain (LBP) was the leading cause of years lived with a disability in 160 countries.^{3,4} Providing a detailed picture of the current global burden of MSD and anticipating their likely future trends is thus crucial to assessing the needs of prevention

and care and health expenses. However, evidence of past and current trends in the occurrence of MSD comes primarily from high-income countries, while evidence in the Global South still needs to be made available.⁵

Several factors may drive the spatial and temporal distribution of MSD. First, several risk factors for MSD have been consistently identified, including occupational exposures such as biomechanical or psychosocial factors.^{6,7} Moreover, estimates of MSD burden are likely affected by under-report, which may be driven by diagnostic capacities and cultural factors, such as perceptions of MSD by caregivers and patients.^{6,8} Therefore, trends in these individual, occupational or diagnostic-related factors may contribute to the temporal and spatial distribution of MSD. Age also constitutes a strong risk factor for MSD. Among the working population, the MSD incidence is globally higher in people over 50 years.^{9,10} Thus, the global variations in demographic structures may also affect the spatial distribution of MSD. Similarly, the global demographic trend of ageing populations may also impact the temporal trends in the burden of MSD.^{11,12} Assessing the contribution of demography in MSD's past trends may thus be insightful to anticipate their fate regarding projected further population ageing.

A global view of the geographical and temporal trends in MSD occurrence still needs to be improved. This study aims to understand the spatio-temporal distribution of MSD worldwide, between 1990 and 2019, for 204 countries and 21 territories, based on an analysis of the GBD 2019 study.

METHOD

Data sources

The GBD is the largest and most comprehensive effort to measure global disease prevalence levels and trends over time.¹³ The GBD is coordinated by the Institute for Health Metrics and Evaluation. The collection of health data as well as the characteristics of individuals, is based on medical claims, general population surveys and medical diagnoses.¹⁴ In addition to collecting data on health events by age, sex and geographical area over time, the GBD produces regular point estimates of the indicators studied with their 95% uncertainty intervals.

The GBD combines health data from various sources, including censuses, household surveys, disease registries and specialised electronic databases. The collection was based on systematic review encompassing 86 249 sources, from academic publications to institutional websites. The GBD has segmented the data according to the countries' development levels. High-income countries with robust recording systems provided primary data.¹⁵ For low-income and middle-income countries, when necessary, complementary techniques have been deployed, such as demographic and health surveys or extrapolation based on similar countries. Given the variability inherent in multiple sources, the GBD employed covariates to adjust the estimates, adapting the data to contextual specificities.

Adjustments were applied to ensure national representativeness, considering the provenance and type of data. A meta-regression model, DisMod, was used to harmonise the data. This model allowed to integrate the various sources, weighting according to their quality, to provide continuous estimates on various indicators, including the prevalence of MSDs. All sources and methodologies are archived within the Global Health Data Exchange. The detail of the GBD protocol is accessible on their website. For our study, we accessed 1990–2019 GBD data at: <https://vizhub.healthdata.org/gbd-results/>.¹⁶ Methods for estimating all the accessible morbidity have been described more fully elsewhere.^{17,18} In brief, all available global data, including vital registration, sample registration, household surveys, censuses, disease registries, reporting systems and police records were identified, extracted and normalised. Standardised methods were then applied to produce consistent estimates of the general population of each country considering fertility, net migration, all-cause mortality and cause-specific mortality.

National income levels were measured using the World Bank income category provided by the GBD, analysed as an ordinal variable (high-income/upper-middle-income/lower-middle-income/low-income country).¹⁶ The national 2017 values of medical density are expressed as the number of healthcare providers per 1000 inhabitants extracted from the World Bank's BIRD-IDA database.¹⁹

Case definition

The present study focuses on MSD of primary origins, for which it is possible to consider primary or secondary prevention policies. Therefore, we excluded MSD from inflammatory origin or resulting from a joint manifestation of organic diseases (such as gout, lupus, psoriasis, certain infectious diseases). We thus included the following definitions, based on two types of MSD data collection: self-reported pain and medically diagnosed osteoarthritis. Both were used for distinct sites: (1) low-back pain, (2) neck pain, (3) hip osteoarthritis, (4) knee osteoarthritis, (5) hand osteoarthritis and (6) other osteoarthritis.

LBP, neck pain (NP) and osteoarthritis (OA) were classified according to the International Classification of Diseases. The 'other osteoarthritis' category represents the most common form of arthritis, involving chronic inflammation, breakdown and structural alteration of the joint. Here, the reference case was radiographically confirmed, symptomatic OA in any joint other than the hand, hip and knee treated independently.^{17–19}

Data collection covered 204 countries and 21 subregions between 1990 and 2019.¹⁶ These subregions were further classified into six larger regions: (1) the Americas, (2) the Caribbean, (3) Europe, (4) Oceania, (4) Asia and (5) Africa. We selected age groups between 20 and 70 years old.

Analysis

Spatial and temporal distribution of the prevalence of MSD across countries and territories, 1990–2019

For each MSD studied, we mapped national raw and age-standardised prevalence (online supplemental file S1). Then we analysed temporal trends of raw and age-standardised prevalence of MSD, by subregions and globally, by computing annual population-weighted average prevalence with the corresponding 95% CI. Temporal trends in raw and age-standardised prevalence were tested using Cochran-Armitage (CA) trend tests. Analyses were conducted on men and women first and then stratified by sex.

The distribution of the prevalence of MSD considering the income level and medical density worldwide

We hypothesised that country-level prevalence of MSD was correlated with national income level, which may be considered as a proxy capturing rough inequalities between countries and indirectly reflecting the level of economic development and relative wealth of a country. Additionally, for medical density we considered that this indicator may capture MSD diagnostic capacities.

This variable was categorised based on the quartiles of its distribution. The independent effect of income level and medical density was explored using multiple linear regression. All analyses were conducted using the R software (V.4.1.1).

RESULTS

Spatial and temporal distribution of the prevalence of MSD by worldwide countries and territories between 1990 and 2019

In 2019, the global raw prevalence mean of MSD were ranged from 0.56% (95% CI: 0.43% to 0.70%) for hip osteoarthritis to 8.62% (95% CI: 7.62% to 9.74%) for LBP, with significant variations across countries (online supplemental file S2). More specifically 0.46% (95% CI: 0.35% to 0.58%) for hip OA, 1.71% (95% CI: 1.27% to 2.29%) for hand OA, 2.34% (95% CI: 1.84% to 2.98%) for NP, 4.34% (95% CI: 3.71% to 5.02%) for knee OA and 8.22% (95% CI: 7.21% to 9.35%) for LBP. Country-specific prevalence ranged from 0.04% (95% CI: 0.02% to 0.05%) for hand OA in Timor-Leste to 18.9% (95% CI: 16.7% to 21.4%) for LBP in Japan, with important variations across MSD and regions (online supplemental file S3). Among the six MSD analysed, lower prevalence levels were consistently observed for sub-Saharan Africa.

The higher overall average prevalence (%) per subregions all year combined was observed in [figure 1](#). They varied between 0.09% (95% CI: 0.06% to 0.13%) for hand OA in Southeast Asia and 15.8% (95% CI: 14.6% to 17.3%) for low back in high-income North America. The lowest overall prevalences (%) per subregions all year combined were for the LBP in Eastern sub-Saharan Africa at 3.9% (95% CI: 3.4% to 4.4%), for NP in Central sub-Saharan Africa at 0.7% (95% CI: 0.5% to 0.9%), for hip OA in Eastern sub-Saharan Africa at 0.1% (95% CI:

0.09% to 0.15%), knee OA in Eastern sub-Saharan Africa at 1.4% (95% CI: 1.1% to 1.6%) and the hand OA in Southeast Asia at 0.09% (95% CI: 0.06% to 0.13%). The highest overall prevalences (%) per subregions all year combined were for NP in Western Europe at 4.7% (95% CI: 3.8% to 5.8%), hip OA in Western Europe at 1.2% (95% CI: 0.9% to 1.6%), knee OA in high-income Asia Pacific at 9.7% (95% CI: 8.5% to 11.0%) and for the hand OA in Eastern Europe at 7.2% (95% CI: 5.5% to 9.4%). The overall average prevalence for all years combined has been observed to be higher in high-income countries for LBP, hip, knee, and other OA. For overall prevalence, in all years combined, NP and hand OA were more elevated in high-income and middle-income countries ([figure 1](#)).

Globally, the prevalences of LBP, hip/hand OA and other OA increase with age in both men and women ([figure 2](#)). The 2019 age-specific prevalence of neck and knee OA increased, then peaked around age 45 for NP and 55 for knee OA. Although absolute levels varied, the shapes of the sex-specific age distributions were similar across subregions. Prevalences were higher in women, except for hip OA in Southern sub-Saharan Africa and other OA, which prevalence was higher in men.

Over time, more than half of the raw prevalence of pain increased significantly. In contrast, after age standardisation, the trends were mainly non-significant except for four decreasing pain trends: three for LBP in Australasia, East Asia and South Asia and one for NP in high-income North America ([table 1](#)). As observed for LBP and NP, most osteoarthritis was explained by hand and other OA demographics. However, unlike LBP and NP, nearly half of the increasing trends remained so after age-standardisation for hip OA (13/22 significant or near-significant increase) and knee OA (6/22 significant increase or near-significant increase).

To compare temporal trends in MSD prevalence by sex, 252 CA trend tests were performed for age-standardised prevalence. Among these tests, differences were observed (online supplemental file S4) for 21 subregions. For LBP, three different temporal trends were highlighted when considering age: in Australasia, the trends are stable for women and decrease significantly in men; in East Asia and South Asia, trends increase significantly for women and reduce significantly for men. There are no differences in time trends of age-standardised MSD for NP. For hip OA, eight temporal trends differences were observed between women and men: in Andean Latin America, Southern Latin America, high-income North America, Tropical Latin America, Australasia and Southeast Asia, stable trends for women and increasing trends for men were highlighted, while for East Asia and South Asia, the decrease was observed in women and an increase was observed in men. For knee OA, five temporal trends in the prevalence of MSD considering age were noticed: in Central Latin America, Tropical Latin America, Caribbean and Southern sub-Saharan Africa, the trends were stable for women and increased in men, while in South Asia, the opposite was seen. Finally, for hand OA, two

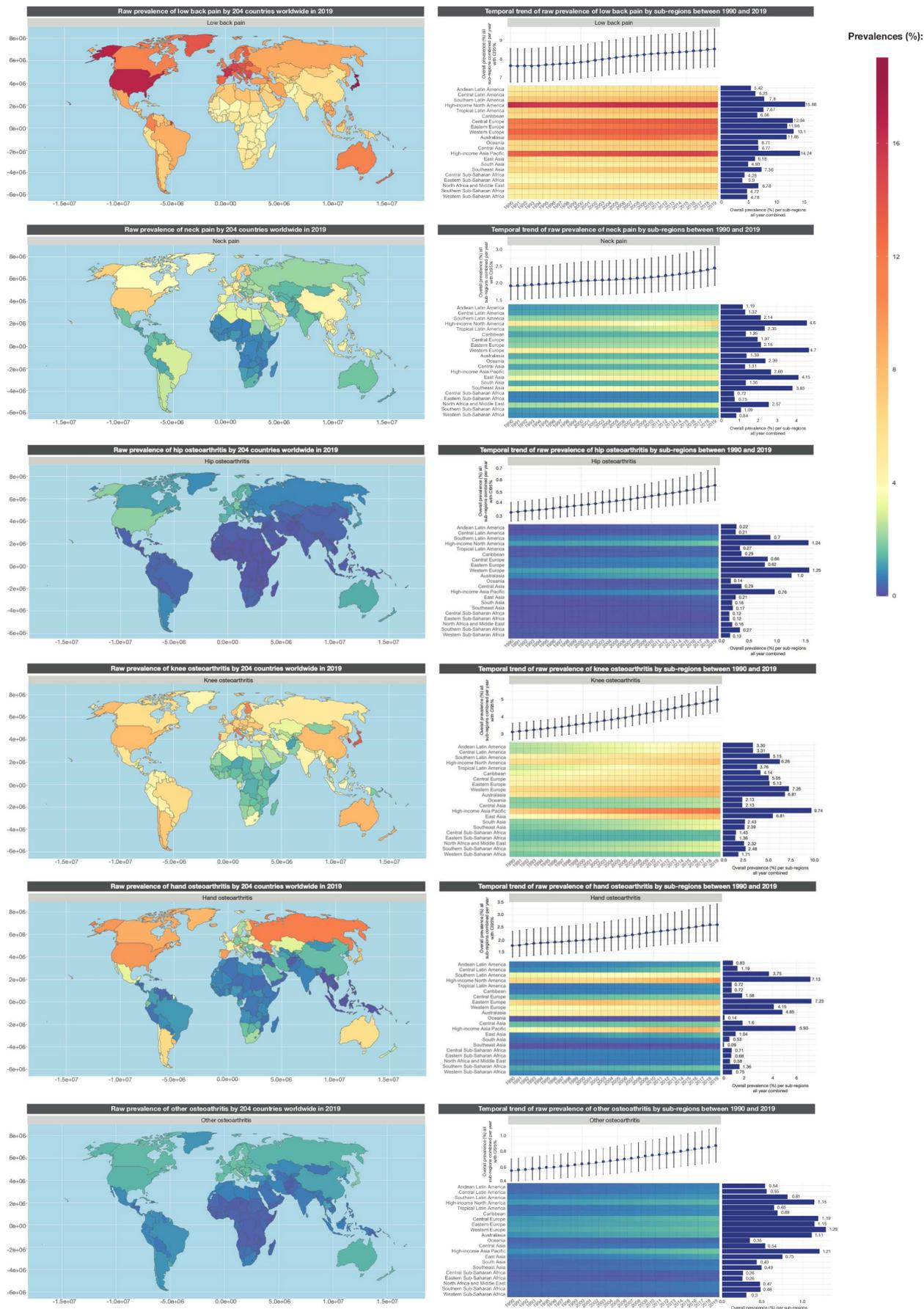


Figure 1 Spatial and temporal distribution of the raw prevalence of MSD worldwide by 204 countries and 21 subregions between 1990 and 2019. MSD, musculoskeletal disorder.

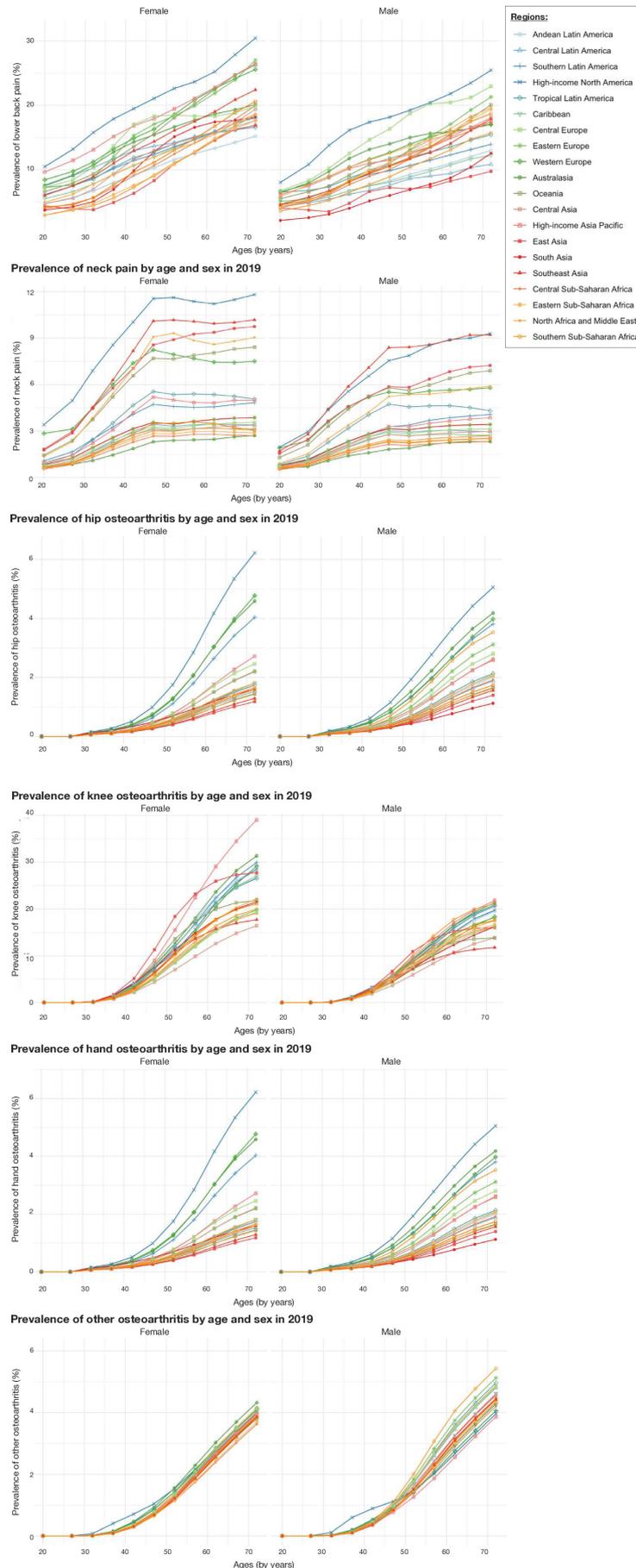


Figure 2 Prevalence of MSD worldwide by subregions, age and sex for 2019. MSD, musculoskeletal disorder.

Table 1 Cochran-Armitage trend tests on the raw and age-standardised prevalence of MSD between 1990 and 2019, by regions and subregions in both sexes

Type of MSD	Osteoarthritis												
	Pain						Other						
	Prevalence	Low back	Neck	Hip	Knee	Hand	Prevalence	Low back	Neck	Hip	Knee	Hand	
Raw	Age-std	Raw	Age-std	Raw	Age-std	Raw	Age-std	Raw	Age-std	Raw	Age-std	Raw	Age-std
America	0.0002***	0.6048	0.0188*	0.5578	4.9e-07***	0.0626	1.1e-13***	0.0521	6.4e-05***	1.00e-04***	0.2029	0.2683	
Andean Latin America	0.0005***	0.4831	0.0075**	0.5639	1.5e-05***	0.2830	4.6e-16***	0.1096	3.5e-06***	0.0001***	0.1371	0.3434	
Central Latin America	0.0300*	0.4247	0.1049	0.4565	0.0001***	0.0218*	6.1e-06***	0.0674	0.0585	0.0047**	0.4713	0.2176	
Southern Latin America	0.2111	0.1269	0.7167	0.0449*	2.2e-05***	0.0495*	0.0006***	0.8182	0.0026**	2.00e-04***	0.2689	0.2006	
High-income North America	0.0016**	0.4644	0.0003***	0.8898	5.8e-08***	0.0761	6.3e-15***	0.0906	0.0004***	0.0001***	0.4561	0.303	
Tropical Latin America	0.0058**	0.4245	0.0542	0.5149	3.7e-05***	0.0985	4.4e-09***	0.1192	0.0123*	0.0014**	0.4765	0.3466	
Caribbean	0.0182*	0.3891	0.0591	0.5671	0.0001***	0.1389	1.4e-07***	0.1613	0.0115*	0.001***	0.4665	0.3181	
Europe	0.0279*	0.5057	0.1469	0.5458	0.0026**	0.1187	0.0001***	0.1506	0.4312	0.0176*	0.9118	0.3278	
Eastern Europe	0.2171	0.2495	0.4195	0.3374	0.0030**	0.1418	0.0001***	0.2210	0.0192*	0.0107*	0.2824	0.3364	
Western Europe	0.3240	0.0956	0.2629	0.3583	1.5e-05***	0.0267*	1.9e-07***	0.0860	0.0468*	0.001***	0.6912	0.2314	
Australasia	0.0708	0.5554	0.1776	0.5169	0.0693	0.3059	0.0031**	0.2013	0.2160	0.1405	0.4940	0.4351	
Oceania													

Continued



Table 1 Continued

Type of MSD	Pain						Osteoarthritis											
	Low back			Neck			Hip			Knee			Hand			Other		
	Prevalence	Raw	Age-std	Raw	Age-std	Raw	Raw	Age-std	Raw	Raw	Age-std	Raw	Raw	Age-std	Raw	Raw	Age-std	Raw
Asia	0.0234*	0.4885	0.0792	0.5445	0.0344*	0.1830	0.0028**	0.2052	0.1496	0.4945	0.1165	0.3821						
High-income Asia Pacific	0.0268*	0.2184	0.0359*	0.5566	2.7e-06***	0.2278	1.4e-14***	0.1897	3.2e-10***	0.0020**	0.0001***	0.3682						
East Asia	0.0077**	0.0102*	0.0028**	0.3813	2.6e-11***	0.0102*	9.5e-23***	0.0232*	0.0001***	0.5226	0.0001***	0.2734						
South Asia	0.6705	0.0006***	0.0450*	0.5502	2.3e-06***	0.0182*	3.4e-09***	0.0710	0.0097**	0.4150	0.0015*	0.3377						
Southeast Asia	0.0001***	0.5026	0.0082**	0.5771	1.3e-06***	0.0800	1.8e-13***	0.0470*	0.0055**	0.4456	2.00E-04***	0.3012						
Africa																		
Central sub-Saharan Africa	0.3846	0.4409	0.3639	0.5145	0.4247	0.3673	0.4164	0.3440	0.4882	0.4648	0.5081	0.4635						
Eastern sub-Saharan Africa	0.2141	0.5049	0.2912	0.5422	0.1474	0.1723	0.1632	0.1899	0.4084	0.4423	0.3406	0.3537						
North Africa and Middle East	0.0024**	0.2870	0.0121*	0.5507	0.0001***	0.0932	5.9e-08***	0.1038	0.0155*	0.4501	0.0035**	0.297						
Southern sub-Saharan Africa	0.0054**	0.4411	0.0547	0.5641	0.0016**	0.1595	5.6e-06***	0.1649	0.0244*	0.4380	0.0121*	0.3337						
Western sub-Saharan Africa	0.4717	0.5022	0.3800	0.6109	0.6406	0.4113	0.5171	0.1886	0.6167	0.4521	0.6765	0.4288						

■, increase, p value<0.05; ■, decrease, p value<0.1; ■, increase, p value<0.1; ■, decrease, p value<0.1; ■, non-significant p value>0.1. MSD, musculoskeletal disorder.

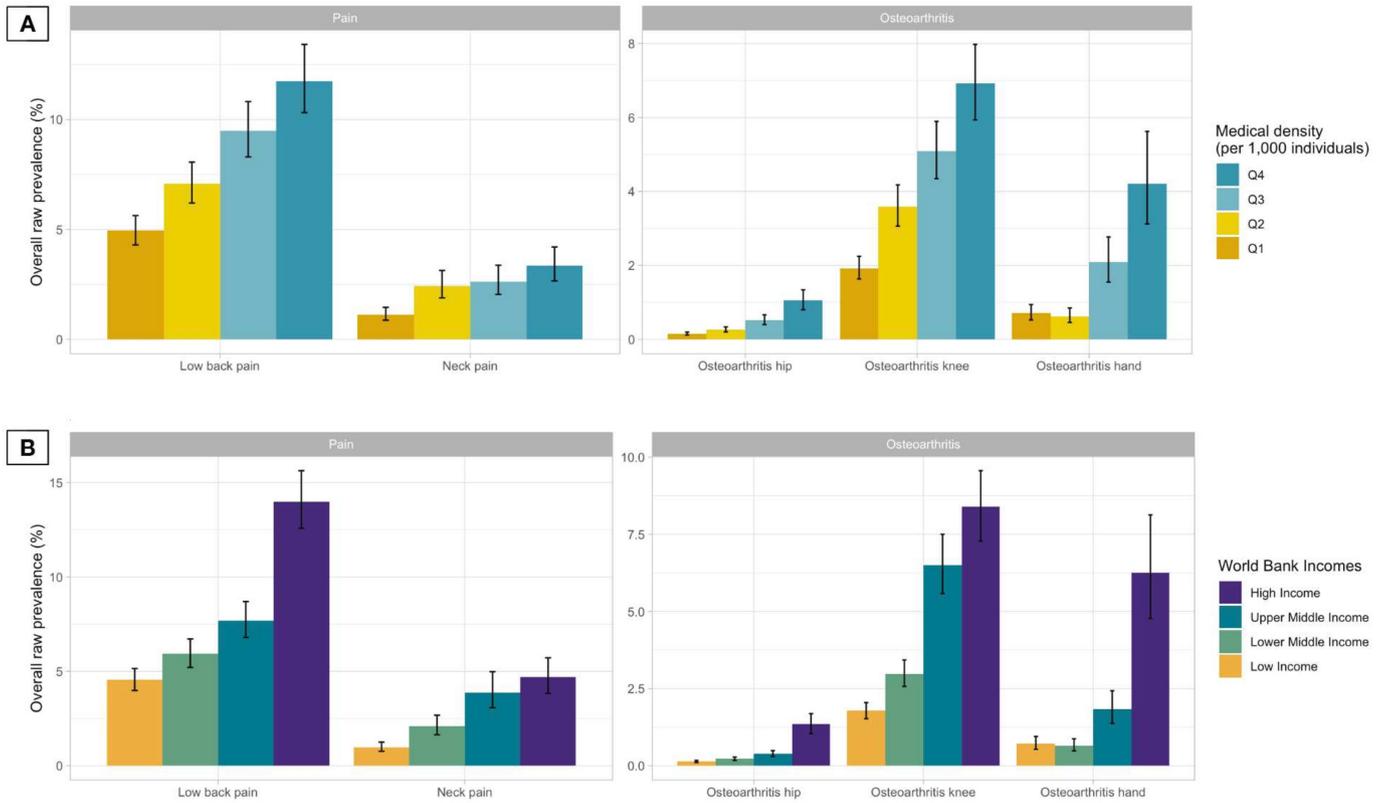


Figure 3 The distribution of the prevalence of MSD considering the World Bank incomes and the medical density worldwide. (A) Distribution of MSD prevalence by World Bank income (low, lower-middle, upper-middle and high incomes) in 2019. (B) Distribution of MSD prevalence by medical density (per 1000 individuals) categorised by quantiles in 2017. MSD, musculoskeletal disorder.

differences in trends were observed: in Eastern Europe, the trends were stable in women and decreased in men, while for high-income Asia Pacific, in women, the trends increased while in men were stable.

The distribution of the prevalence of MSD considering the World Bank incomes and the medical density worldwide

We observed a positive association between the prevalence of MSD for the World Bank income level and medical density (figure 3). In multiple regressions, both variables were independently positively associated with the prevalence for each of the six MSD (online supplemental file S5).

DISCUSSION

In this study, relying on an extensive analysis of six MSD of primary origins, we describe several patterns driving their spatial and temporal distribution. First, we observed large geographical variations in the raw prevalence of MSD across subregions, with a constant trend toward higher prevalence in high-income countries. Second, we observed that the prevalence of MSD increases monotonically with age, except for neck pain, which plateaus or decreases after 45–50 years old. Third, we report that for five out of the six MSD we studied, women were more affected than men, constantly across subregions. Fourth, we document that globally, the raw prevalence of MSD

has significantly increased between 1990 and 2019, with some variations across subregions. This increasing trend is likely to be mainly driven by the ageing of the population, as age-standardised prevalence remained relatively the same over time. Fifth, when studying the drivers of the spatial distribution of MSD, we observed that large variations remain in prevalence levels when controlling for age, suggesting that demographics only cannot explain spatial disparities in MSD prevalence. Subregional levels of income level and medical density were independently associated with a higher prevalence of MSD, suggesting that both labour landscape and diagnostic capacities may affect the local prevalence levels. Furthermore, it is also interesting to note that a probable under-reporting of MSD can partly explain the low prevalence values in low-income countries since, in these countries, research priorities are often directed towards pathologies or health problems requiring rapid action (undernutrition, issues related to geopolitical conflicts, infectious diseases, work-related death or another competitive risk, etc), whereas high income is more on long action (overnutrition, psychosocial ...).

A significant disparity in overall average prevalence between the subregions, all years combined, depending on the MSD, has been observed. For LBP, the difference is a factor of 4, with a 3.9% prevalence in Eastern sub-Saharan Africa and a 15.8% prevalence in high-income

North America. For NP, the prevalence in Western Europe (4.7%) is more than six times higher than in Central sub-Saharan Africa (0.72%). For hip OA, in Central and Eastern sub-Saharan, the prevalence is 0.12% which is 10 times lower than for Western Europe, which has a prevalence of 1.2%. The range between the highest and lowest prevalence for knee OA is more than 7, with a prevalence of 1.3% for Eastern sub-Saharan Africa and a prevalence of 9.7% for the high-income Asia Pacific. Finally, the prevalence of high-income Asia Pacific at 7.2% is about 80 times higher than for Southeast Asia, which has an overall average prevalence for all years combined of 0.09%. Differences in demography do not solely explain these significant variations in prevalence, as large prevalence differences remain while considering age-adjusted prevalence.

This study showed that the most widely high prevalence is attributable to LBP, corroborating previous results from a study published in 2014.²⁰ The raw prevalence of MSD increased between 1990 and 2019 in most subregions of the world, but most of the pains were explained after considering the age factor, while there were still persistent increases for hip, knee and other OA. Depending on the type of MSD, demographic seems to explain most temporal changes in pain. Still, more is needed to understand and apprehend its geographical distribution correctly. Another interesting point is that when observing the prevalence of MSD for 2019 by subregion, sex and age, most of the prevalence increased with age and at a higher level for women. This higher prevalence in women may be due to several reasons: differential exposures; interactions between exposures and gender; effect modification due to male/female social roles, genetics, psychology and physiology; differential pain experience, reporting or care-seeking.²¹ These results improved our understanding of temporal trends in MSD, suggesting that the overall average prevalence of MSD will increase globally over time. Furthermore, in regions where comprehensive income and medical density are lower, the burden of MSD was ranked lower, probably due to a lack of means and accessibility to diagnosis. Added to this is that in recent years, the world population has been ageing, which implies that a considerable number of people living with MSD is expected in the decades to come.²²

Significant disparities in prevalence between countries have been highlighted, especially a marked distinction between the South and the North countries, with higher prevalence in the latter. After age standardisation, OA increase can be explained by the potential underdiagnosis of patients who do not necessarily report their pain because they consider it sufficiently low. In addition, differences in prevalence can be explained by specific characteristics of the populations, not only by the age pyramids but also by obesity,²³ in personal behaviours such as the level of physical activity, the increase of telework²⁴ and/or in professional exposures such as biomechanical and psychological exposures,⁶ ergonomics of

the workstation and the tools used at work,²⁵ cultural factors in the diagnosis of patients²⁶ or even in pain tolerance. These aspects mean that the sensitivity and specificity of the indicators observed undoubtedly vary geographically due to the diversity of the countries' characteristics and the populations' profiles. Among these variations, we can count the differences in definitions, in national income, reflecting a scarcity in the diagnosis of patients. Another factor that can influence a difference in detecting patients is in the variations in medical density which may be used as an indicator of diagnostic capability and probability of detection.⁵ Moreover, the country's treatment arsenal may also indirectly drive the country's diagnostic capacity. Another point to consider is the potential improvement in the sensitivity of diagnostic tools and knowledge of these pathologies in North countries. Given these results, the low prevalence in the middle-income or low-income countries could see their values increase considerably, given the rise in income per country over time and potentially in medical density and accessibility to care.

The observed differences in the prevalence of MSD between high-income and low-income countries could be attributed to various factors such as health habits, cultural differences and the density of health professionals. However, a likely more influential factor would be the quality of primary data and the reduced capacity of poorer countries to measure MSD conditions. Not only because of limited access to healthcare or diagnostic services but more importantly, these disorders may not be among the priority health conditions in national or regional surveillance strategies. Additionally, these countries may not be able to measure these conditions' prevalence for reasons other than access to doctors or diagnostic tests. In this sense, the GBD 2019 study notably highlighted limitations in analysing the burden of diseases and injuries due to the availability of primary data, particularly in low-income countries.¹⁵ These measurement differences are probably particularly marked between countries with high and low incomes, thus explaining a large part of the observed prevalence differences.

The variations in the occurrence of MSD depending on the country can also be explained by the evolution of habits over time, such as whether to practice a physical activity or using transport to get to work. The evolution of professions, the emergence of new jobs or the differences in the distribution of profiles of individuals by job according to their gender, age or social categories can also play a considerable role in the temporal trends of MSD.²⁷ Several examples can be cited, such as construction or transport trades mainly occupied by men versus cashiers, caregivers and housekeepers primarily occupied by women.^{28 29} We must consider several opposing factors that can considerably influence the occurrence of MSD. For example, protective factors such as better knowledge of these pathologies with increasingly effective diagnostic and prevention efforts must be considered as much as the known and emerging risk factors.³⁰ Among the risk

factors that will probably increase, we can cite the evolution and emergence of certain professions requiring increasingly rapid activity, leading to high stress and sometimes non-optimal postural and ergonomic conditions, with different levels of risk factors.^{28 29 31 32} Finally, even if most MSD do not directly lead to death, health is often considerably degraded. Indeed, these pathologies can play a role in premature mortality by inducing combined effects with other pathologies, such as making their diagnosis more difficult.^{33 34}

Despite the study's strength, the GBD data present limitations that must be considered in the interpretations for multiple reasons. First, our analysis disregarded individuals <20 years old or >70 years old, although these younger and older age ranges are also affected by MSDs. However, our choice was driven by the fact to assess the specific prevention needs of the working-age population, among which MSDs emerge as a growing health issue.^{35 36} Second, the GBD estimates rely on various data sources in which quality may differ across countries. Third, for certain countries where the data was incomplete, calibration was used on neighbouring countries (mainly observed for African countries).⁵ Furthermore, this study does not allow us to distinguish whether the differences in prevalence observed according to the MSD and the geographical location of the individuals are due to differences in risk which depend on the characteristics between the regions, such as genetic factors, or whether these differences in prevalence are due to variation in occupational or environmental exposure factors. For example, the reporting dynamics between work-related and non-work-related MSD can be profoundly influenced by a host of socio-economic and socio-cultural factors. In many contexts, under-reporting of work-related MSD is a considerable concern.³⁷ Socio-economic challenges, combined with potential workplace repercussions or lack of awareness, might deter individuals from attributing their MSD to occupational exposures.

This study presents other limitations that could explain an underestimation of the prevalence and the real burden of MSD over time. Case definitions for MSD are not universally standardised and challenging in population studies, making analysis sometimes less precise, especially for different incomes by region.³⁸ Large-scale population studies on the 150 musculoskeletal conditions are challenging to set up due to the exhaustiveness of the pathologies making the setting up of field studies costly.³⁴ Throughout a person's lifetime, there can be a wide variation in the likelihood of a condition, and reporting pain resulting from highly variable musculoskeletal diseases sometimes makes diagnosis difficult, especially in low-income areas with low medical density.

CONCLUSION

MSD are among the most frequent diseases and the most impactful on the quality of life of individuals worldwide. Globally, there is a significant variation of prevalence

between countries and whether the MSD studied is related to pain or OA. The burden of MSD is mainly increasing worldwide, with a great diversity of prevalence between subregions. As the ageing of the global population is rising, this temporal trend is expected to continue.³⁹ Lower back pain is the most widespread worldwide, regardless of the years and locations studied. Over time, the variations in MSD are overwhelmingly increasing, with most of these increases explained by age, particularly for LBP and NP. Demography does not seem to be the only indicator to consider in these variations since, for example, the differences in prevalence observed by country in 2019 highlighted that for all MSD, prevalences are much higher for the North and South countries. In this sense, it has also been shown that income levels and medical densities by region were significantly correlated with observed prevalence. To reduce the burden of these MSD, which tends to increase considerably, it is essential to continue to set up broad surveillance and refine the collection methods by facilitating access to data on a more comprehensive type of MSD.⁴⁰ Exhaustive longitudinal data on a larger panel of MSD and relevant factors, considering risks factors over time, would allow us to understand their evolution better and develop efficient policies for managing and preventing these diseases.^{34 41}

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