EXTENDED REPORT


ABSTRACT

Objectives We used findings from the Global Burden of Disease Study 2013 to report the burden of musculoskeletal disorders in the Eastern Mediterranean Region (EMR).

Methods The burden of musculoskeletal disorders was calculated for the EMR’s 22 countries between 1990 and 2013. A systematic analysis was performed on mortality and morbidity data to estimate prevalence, death, years of live lost, years lived with disability and disability-adjusted life years (DALYs).

Results For musculoskeletal disorders, the crude DALYs rate per 100 000 increased from 1297.1 (95% uncertainty interval (UI) 924.3–1703.4) in 1990 to 1606.0 (95% UI 1141.2–2130.4) in 2013. During 1990–2013, the total DALYs of musculoskeletal disorders increased by 105.2% in the EMR compared with a 58.0% increase in the rest of the world. The burden of musculoskeletal disorders as a proportion of total DALYs increased from 2.4% (95% UI 1.7–3.0) in 1990 to 4.7% (95% UI 3.6–5.8) in 2013. The range of point prevalence (per 1000) among the EMR countries was 28.2–136.0 for low back pain, 27.3–49.7 for neck pain, 9.7–37.3 for osteoarthritis (OA), 0.6–2.2 for rheumatoid arthritis and 0.1–0.8 for gout. Low back pain and neck pain had the highest burden in EMR countries.

Conclusions This study shows a high burden of musculoskeletal disorders, with a faster increase in EMR compared with the rest of the world. The reasons for this faster increase need to be explored. Our findings call for incorporating prevention and control programmes that should include improving health data, addressing risk factors, providing evidence-based care and community programmes to increase awareness.
INTRODUCTION

Musculoskeletal disorders have been underestimated and even ignored for a long time, mainly due to their low fatality rate and being viewed as irreversible conditions or simply part of the ageing process.\textsuperscript{1} The considerable contribution of musculoskeletal disorders is now more clear and several studies have quantified the prevalence and clinical impact of musculoskeletal disorders.\textsuperscript{2} They are also considered by the International League of Associations for Rheumatology as the most common cause of disability.\textsuperscript{3} High frequency, chronicity and severity of musculoskeletal disorders impose a considerable burden on the communities. Population ageing increases the burden of musculoskeletal disorders.\textsuperscript{4} Despite these facts, musculoskeletal disorders are often overlooked and have been viewed as irreversible conditions or simply part of the ageing process.\textsuperscript{5}

The burden of musculoskeletal disorders varies among different regions of the world.\textsuperscript{6} The middle-elevation countries, which include the Eastern Mediterranean Region (EMR), epidemiological data are sparse and not easily comparable in this region come from baseline Community Oriented Program for Control of Rheumatic Diseases (COPCORD). The programme, designed by the International League of Associations for Rheumatology (ILAR), is presumably the most eminent method of tackling the burden of musculoskeletal disorders.\textsuperscript{7} Some countries in the region have no accessible original data on the magnitude and intensity of musculoskeletal disorders.\textsuperscript{8} There are 22 countries in the EMR by WHO designation with different levels of Gross National Income per capita. The low-income countries are Afghanistan, Djibouti, Somalia and Yemen; middle-income countries: Egypt, Iraq, Iran, Jordan, Lebanon, Libya, Morocco, Pakistan, Palestine, Sudan, Syria and Tunisia; and high-income countries: Bahrain, Saudi Arabia, Kuwait, Oman, Qatar and the United Arab Emirates.

In GBD 2013, the burden from six main categories of musculoskeletal disorders was calculated: rheumatoid arthritis, osteoarthritis, low back pain, neck pain, gout and other musculoskeletal disorders. We used the International Statistical Classification of Diseases and Related Health Problems, tenth revision (ICD-10) codes or their equivalent codes in the earlier versions of ICD and assumed different sequelae for each disorder (table 1). Each musculoskeletal disorder had a list of sequelae with potentially different levels of disability; for instance, low back pain had eight sequelae classified as mild, moderate, severe and most severe low back pain with or without leg pain. Range of disability weight for these sequelae was different from 0.02 (95% uncertainty interval (UI) 0.01–

| disorders, equivalent ICD-10 codes and list of sequelae for each disorder in the Global Burden of Disease Study |
|----------------------------------------------------|---------------------------------------------------------------|
| 0 codes | Sequelea (number of sequelae) |
| M06.9, M08.0-M08.89 | Mild, moderate and severe rheumatoid arthritis (3) |
| M13.9, M15-M19.079 | Mild, moderate, severe and osteoarthritis of the hip; mild, moderate and severe osteoarthritis of the knee (6) |
| G54.3, G54.4, G57.0-G57.12, M43.2-M43.5, M43.9, M45-M49, -M49.89, M51-M51.9, M53, M53.2-M54.1-M54.18, M54.3-M54.9, M59.1-M59.9 | Mild, moderate, severe and most severe low back pain without leg pain; mild, moderate, severe and most severe low back pain with leg pain (8) |
| , M50-M50.93, M53.0, M53.1, M54.0-M54.09, M54.2 | Mild, moderate, severe and most severe neck pain (4) |
| M10.19, M10.3-M10.9 | Asymptomatic gout, symptomatic episodes of gout and polyarticular gout (3) |
| L93-L93.2, M00-M03.0, M03.2, M03.6, M07-M08, M08.9-M09.0, , M09.8, M11-M12, M12.2- M12.49, M12.8-M12.9, M14-M14.89, M25.879, M30-M32.9, M34-M36.8, M40-M43.19, M65-M68.8, M73, M73.2, M75-M77.9, M80-M83.4, M83.8-M87.09, M87.3-M89.59, -M95.9, M99.0-M99.09 | Asymptomatic other musculoskeletal disorders and other musculoskeletal disorders severity levels 1–6 (7) |

Classification of Diseases and Related Health Problems, tenth revision.

Original data from other countries of the region are usually limited to specific diseases.\textsuperscript{14–17} In the demographic and health survey of Palestine, 2% of the population reported a diagnosis of musculoskeletal diseases, with an increasing prevalence with age.\textsuperscript{18} Some of the countries in the region have no accessible original data on the magnitude and intensity of musculoskeletal disorders.

There is not a comprehensive summary or comparable data on the burden of musculoskeletal disorders in the countries of this region. In this report, which is part of the Global Burden of Diseases, Injuries, and Risk Factors Study 2013 (GBD 2013), we present the prevalence and burden of musculoskeletal disorders (low back pain, neck pain, osteoarthritis, rheumatoid arthritis, gout and other musculoskeletal disorders) at the regional and national levels in the EMR from 1990 to 2013, as well as the attributable burden from the known risk factors of musculoskeletal disorders.

METHODS

GBD 2013 covers 188 countries, 7 super-regions and 21 regions from 1990 to 2013. In total, 306 causes of diseases and injuries, 240 causes of death and 79 risk factors were systematically analysed. Details on the methodology of GBD studies and the main changes to the methods for GBD 2013 have been explained in previous publications.\textsuperscript{19–21}
0.035) for mild low back pain without leg pain to 0.384 (95% UI 0.256–0.518) for most severe low back pain with leg pain. A complete list of health state descriptions and equivalent disability weights is available in the web appendix of a previous GBD publication.21

In this study, the burden is described as prevalence, deaths, due to premature mortality, years lived disability-adjusted life-years (DALYs), age-standardised rates to be able to dis-population structure from the difference-sex-specific rates.

Musculoskeletal disorder categories (except the category of ‘other musculoskeletal’ to be non-fatal with no mortality and fertile mortality. To estimate the cause-
mortality envelopes (total number of were estimated for each country during 3. All accessible data from vital registration surveys, sample registration data deaths were considered for preparing of death data was extracted from the s any available verbal autopsies.19 We nsemble modelling 22 to estimate the heumatoid arthritis and ‘other musculoskeletal’, sex, country and year, we updated the GBD 2010 systematic al measures for each musculoskeletal ent strategies to avoid missing sources of ring of the results of systematic reviews ork of GBD collaborators.21 A list of ns is available on the Global Health tp://ghdx.healthdata.org/gbd-2013-data-
yesian meta-regression analyses through sed for disease modelling. We used fixed and country-level covariates to adjust le of study-level covariates, we included OA disease definition as the reference extracted data from other studies that porting had a diagnosis of OA, of OA regardless of symptoms’ or ‘OA radiographic confirmation’. More details le in the online appendix of a previous sed epidemiological estimates in con-weights were used to calculate cause-
age, sex, location and calendar year.23 throuh summation of YLLs and YLDs. able burden of the following risk factors of musculoskeletal disorders: occupa-
, high body mass index and low glom-tails on definitions of these risk factors r musculoskeletal disorders are available previous publication.20 % UIs for each quantity in this analysis. king 1000 samples of posterior distribu- and 975th values of the distribution.21ue to musculoskeletal disorders in EMR 5% UI 1380–2090) in 1990 to 5084 9) in 2013, a 198% increase. rate was 0.89 per 100 000 (95% UI 1.39 per 100 000 (95% UI 1.07–1.58) of deaths in 2013 was equal to 0.83 0 (95% UI 0.62–0.95) and constitutes 0.14% (95% UI 0.10–0.16) of all deaths. YLLs of musculoskeletal disorders increased from 68 211 (95% UI 52 961–86 886) in 1990 to 183 659 (95% UI 131 166–219 907) in 2013, a 169% increase.

Web appendix table S1 shows point prevalence of musculoskeletal disorders in the EMR countries. Low back pain was the most common condition in all countries in 2013, except Kuwait and Lebanon where neck pain was more prevalent: the range of point prevalence of low back pain was between 32.45 per 1000 in Kuwait and 159.23 in Egypt. The range of point prevalence of neck pain was between 34.31 per 1000 in Pakistan and >53 per 1000 in Somalia and Djibouti. Osteoarthritis ranged from 29.67 per 1000 in Pakistan to >46 per 1000 in Somalia and Djibouti. Point prevalence of gout had a range of 0.15 per 1000 in Pakistan to 1.00 per 1000 in Iran and Qatar. Point prevalence of rheumatoid arthritis was between 0.88 per 1000 in Saudi Arabia and >3 per 1000 in Somalia and Djibouti (web appendix table 1). YLDs of musculoskeletal disorders increased from 1279 per 100 000 (95% UI 907–1686) in 1990 to 1576 (95% UI 1111–2100) in 2013. Musculoskeletal disorders were the second leading cause of YLDs after ‘mental and substance use disorders’ and accounted for 15.7% of all YLDs (95% UI 13.8–17.7%) in 2013. Low back pain and neck pain had the highest YLDs among the disorders (web appendix 1).

As expected, YLDs were the main component of DALYs for musculoskeletal disorders (>98%, both in 1990 and 2013), and DALY estimates were very close to YLD estimates. The total burden of musculoskeletal disorders was 4842 603 DALYs (95% UI 3450 654–6 359 159) in 1990 and increased to 9 946 874 (95% UI 7 068 174–13 194 791) in 2013, a 105.4% increase in total DALYs of musculoskeletal disorders, compared with a 58.0% increase in the rest of the world. The crude DALYs rate per 100 000 increased from 1297.1 (95% UI 924.3–1703.4) in 1990 to 1606.0 (95% UI 1141.2–2130.4) in 2013, which shows a 23.8% increase. Age-standardised DALY rates were 2055.6 (95% UI 1478.3–2704.1) in 1990 and increased by 2.9% to 2115.9 (95% UI 1517.2–2799.7) in 2013. The burden of musculoskeletal disorders as a proportion of total DALYs has constantly increased since 1990; the proportion that was 2.4% (95% UI 1.7–3.0) in 1990 increased to 3.2% (95% UI 2.8–4.6) in 2000 and 4.7% (95% UI 3.6–5.8) in 2013. Figure 1 compares the burden of musculoskeletal disorders in the EMR to data for the world, low/middle-income countries and high-income countries. Table 2 summarises DALY rates for each musculoskeletal disorder. As shown, DALY rates have been increased during 1990–2013 for all musculoskeletal disorders, both in men and women.

Egypt had the highest and Lebanon had the lowest age-standardised musculoskeletal disorders DALY rates both for males and females. Ranges of age-standardised DALY rates had a considerable overlap between the low-income, middle-income and high-income countries of EMR (table 3).

DALY rates had a clear increasing pattern with age; however, those of middle age had the highest number of DALYs (figure 2). Among different musculoskeletal disorders, low back pain had the highest proportion of DALYs in all age groups. The proportion of osteoarthritis DALYs out of total DALYs of musculoskeletal disorders increased with age. In individuals aged ≥65 years, osteoarthritis was the second important cause of DALYs after low back pain.

The burden of musculoskeletal disorders was higher in females compared with males, except for low back pain and gout. The total burden was 5 415 756 DALYs (95% UI 3 877 474–7 150 503) in females and 4 531 118 DALYs (95% UI 3...
males in 2013. DALY rates were 1800.9 and 1422.2 (95% UI 1004.5–1891.6) respectively. Figure 3 shows the burden of order by sex in 2013. Gout had a small LYS per 100,000 in women and men, has not been shown in the figure.

The ratio of age-standardised female to male musculoskeletal DALY rates ranged between 1.02 in Morocco and 2.01 in Iran (table 3). The ratio of age-standardised female to male DALY rates was <1 for gout disease in all countries of the region. For low back pain, the ratio was <1 except for Sudan (1.02), Egypt (1.03), Saudi Arabia (1.15), Lebanon (1.43) and Iran.

The table below shows the burden of musculoskeletal disorders in the Eastern Mediterranean Region compared with the world, high-income countries and . DALYs, disability-adjusted life-years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate</th>
<th>95% UI</th>
<th>Rate</th>
<th>95% UI</th>
<th>Rate</th>
<th>95% UI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Both</td>
<td></td>
<td>Male</td>
<td></td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>733.6</td>
<td>497.0–1001.2</td>
<td>770.7</td>
<td>519.2–1059.0</td>
<td>694.6</td>
<td>475.0–959.1</td>
</tr>
<tr>
<td>2013</td>
<td>870.6</td>
<td>583.9–1197.9</td>
<td>911.5</td>
<td>612.8–1268.1</td>
<td>827.3</td>
<td>561.2–1148.7</td>
</tr>
<tr>
<td>1990</td>
<td>280.5</td>
<td>194.4–386.6</td>
<td>226.0</td>
<td>156.5–310.0</td>
<td>337.8</td>
<td>235.6–467.5</td>
</tr>
<tr>
<td>2013</td>
<td>351.8</td>
<td>244.5–483.2</td>
<td>274.2</td>
<td>190.2–376.6</td>
<td>434.0</td>
<td>302.8–592.4</td>
</tr>
<tr>
<td>1990</td>
<td>103.8</td>
<td>72.8–140.0</td>
<td>74.9</td>
<td>52.5–101.7</td>
<td>134.2</td>
<td>94.4–181.0</td>
</tr>
<tr>
<td>2013</td>
<td>131.7</td>
<td>92.2–179.0</td>
<td>93.9</td>
<td>65.4–127.1</td>
<td>171.8</td>
<td>120.3–233.9</td>
</tr>
<tr>
<td>1990</td>
<td>33.7</td>
<td>25.4–43.1</td>
<td>25.7</td>
<td>19.3–32.5</td>
<td>42.0</td>
<td>31.1–54.3</td>
</tr>
<tr>
<td>2013</td>
<td>37.6</td>
<td>28.4–48.2</td>
<td>30.3</td>
<td>22.8–38.8</td>
<td>45.2</td>
<td>33.8–58.4</td>
</tr>
<tr>
<td>1990</td>
<td>0.9</td>
<td>0.6–1.2</td>
<td>1.3</td>
<td>0.9–1.8</td>
<td>0.5</td>
<td>0.3–0.6</td>
</tr>
<tr>
<td>2013</td>
<td>1.2</td>
<td>0.8–1.6</td>
<td>1.7</td>
<td>1.2–2.3</td>
<td>0.6</td>
<td>0.4–0.8</td>
</tr>
<tr>
<td>1990</td>
<td>144.7</td>
<td>99.5–200.0</td>
<td>76.6</td>
<td>54.9–104.3</td>
<td>216.3</td>
<td>145.3–303.9</td>
</tr>
<tr>
<td>2013</td>
<td>213.2</td>
<td>151.3–292.2</td>
<td>110.6</td>
<td>80.2–152.8</td>
<td>322.1</td>
<td>224.1–445.2</td>
</tr>
<tr>
<td>1990</td>
<td>1297.2</td>
<td>924.3–1703.4</td>
<td>1175.3</td>
<td>821.4–1558.4</td>
<td>1425.4</td>
<td>1024.4–1879.6</td>
</tr>
<tr>
<td>2013</td>
<td>1606.0</td>
<td>1141.2–2130.4</td>
<td>1422.2</td>
<td>1004.5–1891.6</td>
<td>1800.9</td>
<td>1289.4–2377.7</td>
</tr>
</tbody>
</table>

Low-income countries

<table>
<thead>
<tr>
<th>Countries</th>
<th>Rate 95% UI</th>
<th>Male Rate 95% UI</th>
<th>Female Rate 95% UI</th>
<th>F/M ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-income countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>1463–2621</td>
<td>1880</td>
<td>1350–2473</td>
<td>2151</td>
</tr>
<tr>
<td>1998</td>
<td>1429–2643</td>
<td>1586</td>
<td>1307–2448</td>
<td>2122</td>
</tr>
<tr>
<td>2177</td>
<td>1533–2925</td>
<td>1862</td>
<td>1209–2593</td>
<td>2480</td>
</tr>
<tr>
<td>2040</td>
<td>1438–2728</td>
<td>1880</td>
<td>1289–2590</td>
<td>2165</td>
</tr>
<tr>
<td>1992</td>
<td>1413–2654</td>
<td>1842</td>
<td>1307–2450</td>
<td>2125</td>
</tr>
<tr>
<td>1636</td>
<td>1186–2158</td>
<td>1603</td>
<td>1156–2140</td>
<td>1670</td>
</tr>
<tr>
<td>1287</td>
<td>937–1715</td>
<td>1093</td>
<td>792–1450</td>
<td>1500</td>
</tr>
</tbody>
</table>

The proportion of musculoskeletal disorders’ burden over total burden of disease has even increased. Musculoskeletal disorders are the second leading cause of disability in the EMR. Although population ageing is a main reason for increasing burden of musculoskeletal disorders, a large proportion of the burden is imposed on people in their most active and productive years of life. We did not find a specific association between income level of the country and burden of musculoskeletal disorders; however, the relative importance of risk factors (occupational ergonomic factors compared with high body mass index) was different based on the income level of countries.

Our findings call for incorporating prevention and control programmes for musculoskeletal disorders in national health programmes. COPCORD could be used as a stepwise approach to address the high burden of musculoskeletal disorders; however, previous COPCORD programmes in EMR usually have not progressed beyond the early stages (such as baseline surveys) towards a focus on prevention and control activities.

Considering the important risk factors of musculoskeletal disorders, public education, occupational health and safety and ergonomics are among the most important components of any prevention and control programme. Medical interventions and rehabilitation to preserve functional status are essential to provide control of the situation.

Advocacy is required to raise the attention of policy and decision makers to the disease burden caused by musculoskeletal disorders. As a reflection on the previous round of the ongoing GBD study, some experts recommended extensive involvement.

Table 3: Age-standardised disability-adjusted life year rates (per 100 000) of musculoskeletal disorders by country and sex in the Eastern Mediterranean Region, 2013
to initiate any intervention for control orders and integrating services with exist-
ers. Mody and Brooks suggested new egies to train community health workers providers to detect and initiate the man-
rlier stages. People with musculoskeletal conditions m of services including traditional, com-
ve therapies of which efficacies may not nt biological medications and surgical the long-term outcomes of some mus-
uch as rheumatoid arthritis or severe they can be too expensive to be afford-
imly access to healthcare providers is f the musculoskeletal disorders. For with inflammatory disorders such as early assessment by a specialist improves ver, previous studies show that many oskeletal disorders do not receive treat-
in Lebanon, around a quarter of these nd of treatment. On the other hand, using unnecessary diagnostic or thera-
eople with musculoskeletal symptoms, er countries. This needs to be avoided for quaternary prevention.
le factors (such as maintaining physical , having a balanced diet, avoidance of alcohol consumption, and preventing injuries) is not only beneficial for musculoskeletal health but also for other non-communicable diseases that contribute to increasing mortality and morbidity.

Low back pain and neck pain have the highest burden of musculoskeletal disorders in most of the EMR countries. In previous studies, the seven-day period prevalence of pain for dorsolumbar and cervical spine in Iran were 23.7% and 14.2%, respectively. The estimates were higher in rural areas compared with urban areas, and also in people with specific jobs and pregnant women. In Kuwait, the point prevalence of low back pain in schoolchildren aged 10–18 years old was 20.6% in males and 39.3% in females. A cumulative prevalence of around 28% for low back pain was reported by children aged 11–19 years old in Tunisia. Some of these estimates cannot be directly compared with our estimates due to different de-
finitions and the time interval used for assessment. However, the available evidence collectively reflects the importance of the problem. There are several evidence-based public health and clinical guidelines for low back pain and neck pain, usually from high-income countries. Development of suitable guidelines for use in resource-poor settings is challenging. Most research evidence originates from high-income countries and may not be relevant or applicable to the needs of low-income countries. Moreover, the development of valid clinical guidelines needs resources and certain expertise that sometimes is not available. In the paucity of nationally developed guidelines, EMR countries can use the available guidelines through adaptation processes.

Osteoarthritis is an important cause of disability, especially in elderly people. It is expected to be influenced by the population ageing process more than other musculoskeletal disorders. Some evidence suggests that intensive physical activity might increase.
large joints; however, this is not a

dings on association of physical activity

pecially confusing

in the elderly; while

at walking and physical exercise has a
eoarthritis, there are some reviews that

elder individuals can help to reduce

arthritis.39 Light or moderate physical

known to increase risk or complications

activity can also decrease risk of osteo-
g body mass index.38 39 The burden of

 disorders’ was around threefold in

men. Conditions such as fibromyalgia

orders are more prevalent among

mitations. Although we estimated a col-
culoskeletal disorders in this study, we

e estimations for some of the disorders

 and systemic connective tissue disor-
not separately assess the burden of hand

ication of musculoskeletal disorders

on between symptoms, complaints and

odes clarify the components of each

clude osteoporosis as a disease; instead,
y was classified as a risk factor for frac-
e burden has not been shown in this

t provide separate estimates for diseases

such as the Behçet disease, which have regional importance in

EMR or individual (but not collective) high burden.

There were issues with availability and quality of data in some

EMR countries; however, we used GBD modelling approaches

to reduce this issue. Indeed, the lack of high-quality data in the

region, especially from the 1990s, might have an influence on

the estimated trend of musculoskeletal diseases. Although this

issue exists for many of the causes of diseases, it might have an

balanced effect on musculoskeletal diseases (the importance

of which has been highlighted in the recent decades) compared

with the other diseases. This factor might affect different regions

of the world in different ways. However, we do not believe that

it can purely explain the faster increase in burden of musculo-
skeletal disorders in EMR compared with the rest of the world.

CONCLUSION

Findings from this study show a high burden of musculoskeletal

disorders, especially low back pain, neck pain and osteoarthritis

in the region. The reasons for faster increase of musculoskeletal

disorders’ burden in EMR during 1990–2013 compared with

the rest of the world need to be explored. Our findings call for

integrating prevention and control programmes for musculoskel-
etal disorders with health system programmes. Plans should

clude improving health data to monitor trends, addressing

known risk factors especially through health education and

awareness, ergonomics and occupational health and safety, and
Clinical and epidemiological research

providing evidence-based early diagnosis and treatment, rehabilitative care and community programmes to increase knowledge of risk and protective factors.

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REFERENCES

1 Woolf AD, Akesson K. Understanding the burden of musculoskeletal conditions. The burden is huge and not reflected in national health priorities. BMJ.

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