

## Identification of Musculoskeletal Disorders in Medically Underserved Regions of South America and Vietnam

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**Context:** Musculoskeletal disorders have been implicated as the leading cause of disability throughout the world, representing a high percentage of the disease burden in many nations. Anecdotal evidence suggests that musculoskeletal pain has become increasingly pervasive, especially among rural populations of developing countries.

**Objective:** To characterize specific musculoskeletal disorders in medically underserved regions where these issues have not yet been thoroughly examined.

**Methods:** The sample comprised adult residents receiving care during brief medical outreach trips to South America (Peru, Ecuador, and Argentina) and Vietnam from December 2010 to March 2013. Patients completed an anonymous questionnaire on musculoskeletal pain, self-reported health status, and health care-seeking behavior. Demographic information was also obtained.

**Results:** In Vietnam, 295 patients aged 20 to 88 years (mean [SD], 59 [14.7] years) completed the survey, 204 (69%) of whom were women. In South America, 552 patients aged 18 to 86 years (mean [SD], 44 [17.24] years) completed the survey, 398 (72.1%) of whom were women. Among the Vietnamese patients, acute pain was most frequently felt in the knees (132 [44.7%]), which were also the most frequent site of chronic pain (122 [41.4%]). Among the South American patients, acute pain was felt most frequently in the lower back (225 [47%]), and the upper back (253 [46.6%]) was the most frequent site of chronic pain. Associations were found between sex and chronic pain, with women reporting more chronic pain than men in the shoulder (17 [53%] vs 15 [47%], respectively), upper back (85 [79%] vs 22 [21%]), hand/wrist (153 [85%] vs 52 [15%]), and knee (40 [80%] vs 7 [20%]). Men reported more acute knee pain than women (73 [48%] vs 148 [38%], respectively). For patients in both samples, acute pain was associated with chronic pain in the same location for all body parts ( $P < .01$ ).

**Conclusion:** This study characterized specific musculoskeletal disorders in selected poor and underserved regions in Vietnam and South America. Owing to reported regional differences, the authors recommend that global treatment protocols be developed with a population-specific approach after conducting a needs assessment for musculoskeletal disorders.

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Musculoskeletal disorders represent a high percentage of the disease burden in many nations.<sup>1</sup> Anecdotal evidence suggests that work-related pain has become increasingly pervasive secondary to untreated somatic dysfunction, especially among the rural and indigent populations of developing countries. However, there is a paucity of epidemiologic data that accurately defines the extent and nature of musculoskeletal disorder prevalence in many of the world's poorest regions<sup>2</sup> aside from the Institute for Health Metrics and Evaluation (IHME) Global Burden of Disease (GBD) 2010 report.<sup>3</sup> This report supplies data on disability-adjusted life years due to musculoskeletal disorders in developing nations, and the data support the idea that musculoskeletal disorders are prevalent in these areas and may have a detrimental effect on burden of disease and quality of life.

One of the first steps in the strategic management of bone and joint disorders is an epidemiologic assessment to classify the disorders according to anatomic location and manifestations of musculoskeletal disorders within the given population.<sup>4</sup> Women and elderly persons are frequently identified as the 2 groups with the highest absolute risk for developing somatic dysfunction.<sup>5</sup> Consensus reports from Community-Oriented Program From Control of Rheumatic Diseases (COPCORD) studies have thus far indicated that the majority of musculoskeletal disease burden results from osteoarthritis, for which increasing age is the strongest known predictor, with an added synergistic effect of female sex.<sup>5,6</sup> Worldwide prevalence of osteoarthritis is naturally on the rise as life expectancy improves and the geriatric population increases; however, its disabling effects will be most apparent among the elderly population in developing countries with few medical resources, where surgical interventions such as arthroplasty may not be an option.<sup>6</sup>

Osteoporosis and osteoarthritis are also thought to contribute to the pathogenesis of certain rheumatic conditions, which generally affect women more frequently than men.<sup>6</sup> A survey of musculoskeletal diseases in Aus-

tria found a nearly 6-fold increase in the prevalence of osteoporosis among women compared with men (10.6% and 1.9%, respectively), as well as higher odds among women for developing spinal disorders (OR, 0.92).<sup>7</sup> A British investigation into the negative predictors of somatic dysfunction presented concordant results, in which men were most likely to be in good musculoskeletal health, and women and elderly persons had more frequent reporting of musculoskeletal pain.<sup>8</sup>

Although a higher prevalence of musculoskeletal disorders has been well documented in settings of poverty and, notably, among indigenous populations of South America and Eastern Asia,<sup>2,9-13</sup> data are lacking on the most common anatomic locations and types of pain experienced by people in these regions, all of which are important elements in a systematic classification model. As public health strategists have pointed out, this type of assessment is essential in the planning of community-based approaches to musculoskeletal management in underserved settings.<sup>2,4</sup> Interpretation of these data within the context of demographic subsets may identify population-specific causes and risk factors for somatic dysfunction and could ultimately lead to better-focused treatment plans and more efficient use of medical resources.<sup>14</sup>

The purpose of the current investigation was to characterize specific musculoskeletal disorders in medically underserved regions of Peru, Ecuador, Argentina, and Vietnam—geographic areas that have not yet been thoroughly examined in this context. Data on self-reported musculoskeletal pain and demographic factors were obtained through voluntary anonymous surveys conducted by participants in one of our university's osteopathic medical outreach programs. Our goal was to create a resource that could assist local medical providers in developing therapeutic guidelines to address musculoskeletal problems in patients in these and similar regions. In identifying the prevalence of certain musculoskeletal disorders in these patient populations, researchers and medical providers could then develop guidelines for musculoskeletal treatment services in these underserved areas.

## Methods

The university's institutional review board approved the current descriptive, cross-sectional, survey-based study. The purpose of the present study was to assess the prevalence of musculoskeletal disorders in selected medically underserved regions in the Ben Tre province of Vietnam and in South America: Quito and Milpe, Ecuador; Piura, Peru; and Santo Tomé, Corrientes Province, Argentina; between 2010 and 2013. Each year, the Nova South-eastern University College of Osteopathic Medicine in Fort Lauderdale, Florida, sends students, faculty, and volunteer physicians to rural areas to provide health care services that are otherwise difficult for patients to access. The volunteer physicians specialize in various disciplines, such as internal medicine, dermatology, family medicine, and osteopathic manipulative medicine. Osteopathic medical students were trained as research assistants for the purpose of the present study.

Patients attending the outreach programs were invited by a translator if needed to answer a brief survey at the time of registration or in the waiting area. This oral invitation included a brief discussion of the purpose of the study and the benefits of gathering information from the patient population, and patient eligibility was ascertained. Inclusion criteria were a current patient of the medical outreach program aged 18 years or older. Eligible patients were then provided a written consent form, in their native language, that explained the purpose of the study, the voluntary nature of their participation, the anonymity of the data, possible risks and benefits, plans for dissemination of the findings, how to contact the researchers and the institutional review board, and instructions for completing the questionnaire. Patients were also informed that they could discontinue participating in the study at any time. In addition, no incentives for participation were provided. The current study was separate from the clinical care provided. No information was obtained from the patients' medical records.

The 1-page survey was offered in Spanish and Vietnamese and took approximately 10 minutes to complete.

The research team members—experts in osteopathic manipulative treatment (OMT) techniques, the culture and language of the given population, and indigent health issues—checked the survey for both face and content validity. Data were collected by research assistants. Demographic items collected included age, self-reported height, weight, sex, and occupation. General health status was assessed using a 4-point Likert-type scale with the responses “good,” “reasonably good,” “not too bad,” and “poor.” Patients were also asked how many times they had seen a physician in the past year. The remaining survey items asked patients if they had pain or discomfort in various parts of the body in the past 12 months and in the past 7 days using a yes/no response set (*Figure*).

### Instrument Translation

The method of forward and backward translation and cultural adaptation were used to translate the instrument from English to Spanish. The result was a questionnaire that was acceptable across South American cultures. To attain the semantic equivalence of the measures across cultures, strategies to maintain fidelity in replicating core components included accurate forward translation/backward translation and cultural brokerage—that is, reviewing content for cultural appropriateness. The questionnaire included vocabulary of common use and content relevant to different Spanish-speaking groups (eg, Peruvian, Ecuadorian, Argentinian) and items similar in meaning to those of the English language instrument. We used bilingual researchers from various cultural backgrounds in South American countries who were experienced in Spanish/English translation. The translation of the instrument into Vietnamese was conducted by a certified translation company.

### Statistical Analysis

Descriptive Pearson  $\chi^2$  and Pearson  $r$  correlation analyses were conducted using SPSS statistical software to de-

scribe the patients' demographic characteristics, number of times they had seen a physician in the past year, self-reported health status, acute and chronic musculoskeletal problems, and associations between musculoskeletal pain, sex, age, and self-reported health status.

## Results

### Demographics

In Vietnam, 295 patients aged 20 to 88 years (mean [SD], 59 [14.7] years) completed the survey, 204 (69%) of whom were women. By occupation, gardeners/landscapers made up 119 (40.3%) patients; government workers, 11 (3.7%); farmers, 14 (4.7%); and other, 90 (30.5%). The remaining patients (61 [20.7%]) declined to answer.

In South America, 552 patients aged 18 to 86 years (mean [SD], 44 [17.24] years) completed the survey, 398 (72.1%) of whom were women. By occupation, homemakers comprised the largest group, (160 [29%]). The second largest group was worker/driver/agricultural workers (65 [11.8%]). Forty-four patients (8%) reported being unemployed or retired. The rest of the patients were laborers, teachers, and students. Although the age range and sex composition of both samples were similar, the South American sample was younger (mean age, 43.8 years vs 59.4 years in the Vietnamese sample). Comparisons of occupation were difficult to assess among the Vietnamese patients because many did not respond to this item on the questionnaire.

### Self-Reported Health Status

In the Vietnamese sample, overall self-rated health status was reported as "good" (73 [24.7%]), "reasonably good" (133 [45.1%]), and "not too bad" (89 [30.2%]). No patient from this sample self-rated his or her health as being "poor." In the South American sample, overall self-rated health status was reported as "good" (153 [29.4%]), "reasonably good" (158 [30.4%]), "not too bad" (154 [29.6%]), and "poor" (55 [10.6%]).

#### Demographic Questions

Are you aged 89 years or older?

If you are younger than 89 years, how old are you?

What is your gender?

How tall are you?

What is your weight?

What is your occupation?

How many times have you seen a medical doctor in the past year?

#### Musculoskeletal Questions (past year)

How is your health status in general?<sup>a</sup>

Have you had pain or discomfort during the past year in [any of the following body parts]?<sup>b</sup>

#### Musculoskeletal Questions (past 7 days)

Have you had pain or discomfort during the past 7 days in [any of the following body parts]?<sup>b</sup>

#### Figure.

English-language version of the musculoskeletal survey administered to patients in South America and Vietnam. <sup>a</sup>"Good," "reasonably good," "not too bad," or "poor." <sup>b</sup>Neck, shoulder, upper back, elbow, lower back, wrists/hands, hips/thighs, knees, or ankles/feet.

### Medical Care Use

About one-fourth (n=69) of the Vietnamese patients had not seen a physician in the past year, 98 (33.2%) saw a physician once, 48 (16.3%) saw a physician twice, 37 (12.5%) saw a physician 3 times, and 41 (13.8%) saw a physician 4 or more times in the past year.

One hundred twenty-six patients (24%) in the South American countries reported not seeking medical treatment in the past year; 13 (21.4%) saw a physician once, 86 (16.3%) saw a physician twice, and 70 (13.3%) saw a physician 3 times. The remaining patients saw a physician 4 or more times in the past year. Demographic characteristics, self-reported health status, and medical care use statistics are presented in *Table 1*.

### Musculoskeletal Complaints

*Table 2* describes self-reported acute and chronic musculoskeletal complaints in both geographic regions. For

**Table 1.**  
**Demographic Characteristics, Medical Care Use,**  
**and Self-Reported Health Status by Geographic**  
**Region (N=847)**

Characteristic	No. (%)	
	Vietnam <sup>a</sup> (n=295)	South America <sup>b</sup> (n=552)
<b>Sex</b>		
Women	204 (69)	398 (72)
Men	91 (31)	154 (28)
<b>Age, y</b>		
18-29	14 (4.7)	144 (26.1)
30-39	12 (4.1)	107 (19.45)
40-49	33 (11.2)	106 (19.2)
50-59	87 (29.5)	73 (13.2)
60-69	71 (24.15)	63 (11.45)
70-79	50 (16.9)	50 (9.1)
≥80	28 (9.5)	9 (1.6)
<b>No. of Physician Visits in Past Year</b>		
0	70 (23.7)	126 (22.8)
1	98 (33.2)	113 (20.5)
2	48 (16.3)	87 (15.8)
3	37 (12.5)	70 (12.7)
≥4	42 (14.2)	156 (28.3)
<b>Self-Reported Health Status</b>		
Good	73 (24.7)	153 (27.7)
Reasonably good	133 (45.1)	158 (28.65)
Not too bad	89 (30.2)	154 (27.95)
Poor	0	55 (10.0)
No response	NA	32 (5.8)

<sup>a</sup> Mean (SD) age, 59.4 (14.7) y; range, 18-88 y.

<sup>b</sup> Mean (SD) age, 43.8 (17.2) y; range, 18-86 y.

**Abbreviations:** OMT, osteopathic manipulative treatment; OPP, osteopathic principles and practice.

patients in both regions, classification of musculoskeletal complaints varied according to age, sex, and symptom duration (acute vs chronic). As expected, acute pain was associated with chronic pain in the same body part ( $P<.01$ ) for all body parts.

In the Vietnamese sample, acute pain was most frequently found in the knees (132 [44.7%]), which were also the most frequent site of chronic pain (122 [41.4%]). Pain in the upper back was the second most reported complaint (acute, 104 [35.3%]; chronic, 107 [36.3%]). Associations were found between sex and chronic pain, with women reporting more chronic pain than men in the neck (56% [9] vs 44% [7], respectively), shoulder (17 [53%] vs 15 [47%]), upper back (85 [79%] vs 22 [21%]), hand/wrist (85% [40] vs 15% [7]), and knee (40 [80%] vs 7 [20%]). Older age was associated with chronic pain in the lower back ( $P<.05$ ) and knee ( $P<.05$ ) and acute pain in the knee ( $P<.05$ ). Lower self-rated health status was associated with a greater number of reports of acute and chronic upper back pain ( $P<.05$ ), chronic elbow pain ( $P<.05$ ), and acute and chronic knee pain ( $P<.05$ ) (Table 3).

In the South American sample, acute pain was reported to occur most frequently in the lower back (225 [47%]), and the upper back was the most frequent site of chronic pain (253 [46.6%]). Men reported more acute knee pain than women (73 [48%] vs 148 [38%], respectively). Older age ( $P<.05$ ) and lower self-rated health status ( $P<.05$ ) were both associated with a greater number of reports of acute and chronic pain in all body parts (Table 3).

## Discussion

To our knowledge, this is 1 of few studies to examine and classify musculoskeletal disorders according to anatomic location and demographics through a survey in medically underserved regions of South America and Vietnam. One of our most notable findings was the generally high incidence of musculoskeletal symptoms

within the sample; all of the respondents reported either acute or chronic pain in at least 1 body part. Population studies conducted among comparably indigent communities in India and Australia yielded similar numbers, with the latter reporting 100% prevalence of musculoskeletal pain in a sample of rural, indigenous dwellers, 64% of which were chronic conditions (ie, duration of >1 year).<sup>15,16</sup> These findings are consistent with the World Health Organization's view that underdeveloped nations bear the greatest burden from musculoskeletal disease worldwide,<sup>6</sup> which likely contributes to the overall poor health status often encountered in settings of poverty.

The association between acute pain and chronic pain in the same location among respondents ( $P<.01$  for all body parts) suggests a widespread progression of untreated somatic dysfunctions into chronic conditions over time. However, owing to the limited nature of the questionnaire, it remains unclear as to whether a true causative relationship exists. Further detail from the patients' histories and physical examinations would be needed to ascertain the significance of this association, which may indicate that longstanding somatic dysfunctions predispose patients to new acute injuries in the same body parts or vice versa.

### Sex

In South America, the most commonly reported site of somatic dysfunction in both sexes was the lower back, with significantly higher proportions of both acute and chronic lumbar pain observed among women. This finding is consistent with international literature reporting that women are more susceptible than men to lower back injuries, owing to structural anatomy, which is often compounded by the stress of childbearing and social factors.<sup>6,14,15</sup> Two other studies in which surveys were taken among patients at rural health centers in Peru and Ecuador also indicated that cultural gender roles have some influence on the type of treatment sought. For example, women tended to access mainly prenatal and

**Table 2.**  
**Self-Reported Acute and Chronic Musculoskeletal Complaints by Geographic Region (N=847)**

Musculoskeletal Complaint	No. (%)	
	Vietnam (n=295)	South America (n=552)
<b>Acute<sup>a</sup></b>		
Neck	13 (4.4)	221 (40)
Shoulders	27 (9.2)	189 (34.2)
Upper back	104 (35.3)	242 (43.8)
Elbows	92 (31.2)	125 (22.6)
Lower back	28 (9.5)	255 (46.2)
Wrist/hands	50 (16.9)	168 (30.4)
Hips/thighs	13 (4.4)	178 (32.2)
Knees	132 (44.7)	221 (40)
Ankles	40 (13.6)	198 (35.9)
<b>Chronic<sup>b</sup></b>		
Neck	16 (5.4)	264 (47.8)
Shoulders	32 (10.8)	247 (44.7)
Upper back	107 (36.3)	290 (52.5)
Elbows	86 (29.2)	122 (22.1)
Lower back	23 (7.8)	293 (53.1)
Wrist/hands	47 (15.9)	205 (37.1)
Hips/thighs	16 (5.4)	220 (39.9)
Knees	122 (41.4)	244 (44.2)
Ankles	52 (17.6)	216 (39.1)

<sup>a</sup> Past 7 d.

<sup>b</sup> Past 12 mo.

other primary care services, whereas men typically presented only in cases of acute injury such as farming accidents.<sup>16,17</sup> About 25% of patients reported visiting a physician more than 4 times in the past year, compared with 13% in Vietnam. The majority of these patients were women, which might also explain the higher incidence of chronic pain in the female population, leading to more frequent health-seeking behavior.

**Table 3.**  
**Association Among Musculoskeletal Pain, Age, and Self-Reported Health Status in 2 Medically Underserved Geographic Populations (N=847)**

Region of Pain	Pearson <i>r</i> Correlation			
	Vietnam (n=295)		South America (n=552)	
	Age	Self-Reported Health Status	Age	Self-Reported Health Status
<b>Acute Pain</b>				
Neck	0.027	0.074	0.172 <sup>b</sup>	0.166 <sup>b</sup>
Shoulders	0.011	0.007	0.218 <sup>b</sup>	0.192 <sup>b</sup>
Upper back	0.079	0.138 <sup>a</sup>	0.229 <sup>b</sup>	0.261 <sup>b</sup>
Elbows	0.022	0.159 <sup>b</sup>	0.229 <sup>b</sup>	0.226 <sup>b</sup>
Lower back	0.098	0.024	0.309 <sup>b</sup>	0.251 <sup>b</sup>
Wrist/hands	0.050	0.052	0.266 <sup>b</sup>	0.217 <sup>b</sup>
Hips/thighs	0.036	0.029	0.296 <sup>b</sup>	0.261 <sup>b</sup>
Knees	0.180 <sup>b</sup>	0.312 <sup>b</sup>	0.391 <sup>b</sup>	0.272 <sup>b</sup>
Ankles	0.024	0.016	0.322 <sup>b</sup>	0.254 <sup>b</sup>
<b>Chronic Pain</b>				
Neck	0.085	0.043	0.155 <sup>b</sup>	0.155 <sup>b</sup>
Shoulders	0.038	0.040	0.208 <sup>b</sup>	0.184 <sup>b</sup>
Upper back	0.053	0.212 <sup>b</sup>	0.192 <sup>b</sup>	0.218 <sup>b</sup>
Elbows	0.002	0.135 <sup>a</sup>	0.298 <sup>b</sup>	0.269 <sup>b</sup>
Lower back	0.183 <sup>b</sup>	0.073	0.172 <sup>b</sup>	0.166 <sup>b</sup>
Wrist/hands	0.027	0.081	0.218 <sup>b</sup>	0.192 <sup>b</sup>
Hips/thighs	0.032	0.003	0.229 <sup>b</sup>	0.261 <sup>b</sup>
Knees	0.157 <sup>b</sup>	0.320 <sup>b</sup>	0.229 <sup>b</sup>	0.226 <sup>b</sup>
Ankles	0.006	0.002	0.309 <sup>b</sup>	0.251 <sup>b</sup>

<sup>a</sup> Correlation is significant at the .01 level (2-tailed).

<sup>b</sup> Correlation is significant at the .05 level (2-tailed).

### Self-Reported Health Status

Overall self-reported health status is a variable frequently used by the World Health Organization to monitor the health status of populations, and it is recognized as a reliable indicator of disease presence.<sup>1</sup> In the South American sample, we found that lower ratings of self-reported health status were associated with acute

and chronic pain in all body parts ( $P < .01$ ). In the Vietnamese sample, poor self-reported health was significantly associated with chronic pain in the upper back, elbows, lower back, and knees, and with acute pain in the upper back, elbows, and knees ( $P < .01$ ). The finding that pain was associated with self-reported health status is aligned with the osteopathic theory that internal

maladies (ie, nerve pain) often manifest as structural body dysfunction.<sup>18</sup> However, a COPCORD study<sup>19</sup> conducted in farming villages of Southern India found that musculoskeletal complaints of greater than 5 years' duration had a lesser effect on overall health-related quality of life in comparison with musculoskeletal complaints of more recent onset. This finding was attributed to the ability of rural populations to adapt to chronic pain in the absence of treatment options.<sup>19</sup>

Lower self-reported health scores and increasing numbers of musculoskeletal complaints were also significantly associated with older age, again highlighting the prominent effect of somatic dysfunction on quality of life in the elderly population. This finding is parallel to the findings of Rohrer et al<sup>16</sup> in their investigation of musculoskeletal disease burden in rural Peruvian villages, which determined that poor self-rated health was more likely to be found in older age groups and in those with joint pain. Older age was also associated with a greater amount of acute and chronic pain in every part of the body (neck, shoulder, upper back, elbows, lower back, wrists/hands, hips/thighs, knees, and ankles/feet). In concurrence with many worldwide musculoskeletal studies that have clearly acknowledged a higher prevalence of widespread bone and joint pain in older age groups,<sup>1,2,14</sup> we found that older age was strongly correlated with the presence of pain. As mentioned previously, older age is an inevitable risk factor for progression of inflammatory arthropathies, which tend to be polyarticular.<sup>6</sup> Therefore, this finding was expected.

### **Implications for Medical Practice**

Treatment approaches in settings with limited medical resources should integrate horizontal strategies—those aimed at improving the accessibility of health care services and reducing disease burden at the population or community level—along with vertical interventions, or direct care programs, that address specific areas of need within demographic subgroups.<sup>19</sup> For example, aggressive prevention of degenerative joint disease in elderly

populations is recommended as a primary area of focus regardless of geographic location,<sup>20</sup> and it is also supported by our findings. Halting the progression of somatic dysfunction to chronic disabling disorders may be best achieved through affordable and noninvasive adjunctive treatments such as myotherapy and OMT techniques, which are shown to be highly effective in resource-poor settings when administered alongside standard modalities of care. On the basis of the findings of the current investigation, we recommend that global treatment protocols be developed with a population-specific approach after conducting a regional needs assessment, bearing in mind that health interventions in rural and underserved communities are more effective when strategically tailored.<sup>19</sup>

### **Clinical Recommendations for Underserved Regions**

Based on the observed cultural and occupational trends, community-based interventions geared at improving the health and safety of agricultural workers are a crucial element of any future treatment strategy implemented. Simple ergonomic and postural stability measures should be encouraged whenever possible, highlighting the imminent danger posed by haphazard equipment and machinery alongside the long-term risk of developing joint disease secondary to chronic inflammation. Disseminating informational materials to landowners and employers may prove equally if not more important than direct patient education, as these rural farming communities commonly operate according to a hierarchical structure typical of most agriculturally based societies.

Failure to communicate with those holding positions of power at the community level or to establish with them an understanding of occupational risks could compromise treatment outcomes and undermine preventive efforts. Likewise, patient education should emphasize worksite safety as well as home exercises, core-strengthening techniques, and supportive footwear, although the latter may not be easily available to them.

Local health care providers could benefit from focused training in the management of knee injuries as well as certain minor orthopedic procedures such as arthrocentesis and corticosteroid injections, provided that they could be performed using a sterile technique. All regional women's health care practitioners, including obstetrician/gynecologists, traditional midwives, and village health care workers, should be offered basic training in osteopathic principles and practice, because they may be the only health care workers who care for the female population as a result of traditional customs and transportation barriers to accessing primary care in remote settings. Diagnostic methods and management of somatic dysfunction in the upper extremities, neck, and shoulders would be most practical, with suggested therapies including osteoarthritis and cervical decompression maneuvers, the Spencer shoulder sequence, and muscle energy or myofascial release of the cervical and upper thoracic paraspinal musculature.

### **Osteopathic Manipulative Treatment**

Guided by osteopathic principles and practice, OMT is applied to the overall management of a broad clinical spectrum that includes musculoskeletal pathology, injuries, and chronic diseases. Osteopathic manipulative treatment is specifically directed toward correcting or reversing somatic dysfunctions involving joints, muscles, fasciae, tendons, and ligaments. Therapeutic goals include pain relief, realignment of bony structures to restore functional range of motion, and release of impediments to neurovascular flow to optimize physiologic functions within multiple organ systems. Various OMT techniques may be used to target a specific area of the musculoskeletal system or to improve overall postural balance.<sup>22</sup>

By decreasing the progression of acute somatic dysfunctions into chronic or permanent disabling disorders, OMT has been shown to facilitate recovery from musculoskeletal injury.<sup>23</sup> In military personnel with acute lower-back strains, treatment protocols that included

scheduled muscle energy and high-velocity, low-amplitude techniques over a period of 4 weeks reduced the severity of self-reported pain by at least 30%, a significantly better outcome than pharmaceutical therapy and reassurance alone.<sup>24</sup> Similar results have been observed in studies of chronic disorders of the hips, knees, and other sites of injury.<sup>23,25</sup>

The scope of osteopathic manipulative medicine extends beyond the primary therapeutic goal of focused somatic interventions, encompassing a wide range of patient-education and preventive strategies that offer additional benefits for vulnerable and underserved populations. The use of hands-on techniques often enhances patient centeredness in clinical encounters, which may have an indirect effect on concomitant psychosocial factors and can improve overall quality of life, especially for neglected groups such as elderly persons and those who are medically indigent.<sup>21</sup>

Our findings suggest that OMT interventions in these regions should be heavily targeted at women and the elderly population, which are the 2 highest-risk groups with chronic pain and disability caused by somatic dysfunction. Myofascial release and lumbosacral balancing techniques would help provide these patients with some degree of physical relief.

Regarding occupational disorders, specifically those related to agriculture and household tasks, techniques should be aimed at reducing the chronic inflammation induced by repetitive work-associated postures and maneuvers. Supplemental training for local health care practitioners should include the management of common upper-extremity tendinopathies and nerve entrapments such as carpal tunnel syndrome, as well as practical instruction in routine muscle-energy; high-velocity, low-amplitude; joint stabilization; and radioulnar and carpo-metacarpal articulatory techniques.

### **Limitations**

The brevity of responses obtained through the questionnaire format, which lacked the historical detail needed to

establish the context of musculoskeletal complaints, was one limitation. More specific parameters will therefore be included in future databases for our medical outreach programs. Furthermore, selection bias may have contributed to associations that would not apply to the general population. For instance, the sample consisted exclusively of patients who were seeking medical care during a medical outreach program, which could have predisposed them to musculoskeletal disorders in comparison with healthy controls. Further, a notable selection sex bias was reflected in the South American sample, composed of 72% women and 29% men. We acknowledge that the sample data are neither a complete enumeration of all of the possible data nor a careful, scientific sample. Absent a probability-based selection procedure, it is nearly impossible to describe quantitatively the relationship between a convenience sample and the underlying population of interest. Also, we combined the patients in the South American countries, making it impossible to discern any nuances among the different South American countries. However, the conclusions drawn from this survey can be useful to direct more focused research efforts to classify musculoskeletal disorders in these body areas in resource-poor geographic regions in regard to treatment efficacy, for which a longitudinal investigation may be more appropriate.

## Conclusion

The growing burden of musculoskeletal disorders in developing nations is a major concern that requires prompt intervention to prevent further disability. This assessment of musculoskeletal disorders in underserved communities in these regions provides an initial cross-sectional overview to elucidate trends and musculoskeletal body areas in need of treatment. Additionally, our findings may support the integration of OMT into traditional medical models. The high prevalence of somatic dysfunction in these geographic regions, observed in correlation with poor self-reported health

status, emphasizes the imperativeness of including musculoskeletal management in all strategies aimed at improving overall health.

## Author Contributions

Dr Jacobs provided substantial contributions to conception and design, acquisition of data, and analysis and interpretation of data; Drs Collias, Rana, and Kane helped draft the article or revised it critically for important intellectual content; and Drs Wallace and Boesler gave final approval of the version of the article to be published.

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