In rural Tibet, the prevalence of lower limb pain, especially knee pain, is high: an observational study

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Question: What is the point prevalence and 12-month prevalence of lower limb musculoskeletal pain in rural Tibet? Does this differ with gender or age? What factors that could contribute to lower limb musculoskeletal pain are commonly present? Design: Observational study using an investigator-administered questionnaire and observation walks through villages. Participants: 499 people aged 15 years and over living in 19 rural villages of Shigatse Municipality, Tibet. Results: The point prevalence of lower limb musculoskeletal pain was 40% (95% CI 34 to 46) while the 12-month prevalence was 48% (95% CI 42 to 54). In particular, the point prevalence of knee pain was 25% (95% CI 20 to 30) and the 12-month prevalence was 29% (95% CI 23 to 35), which was significantly higher than at any other site in the lower limb. On average, being female was not associated with lower limb musculoskeletal pain either currently (OR 1.3, 95% CI 0.9 to 1.9) or over the previous 12 months (OR 1.2, 95% CI 0.9 to 1.8), whereas being older than 50 years was, both for current pain (OR 4.1, 95% CI 2.8 to 6.1) and pain over the previous 12 months (OR 4.0, 95% CI 2.7 to 6.0). Observation walks through the villages revealed people squatting for sustained periods, carrying heavy loads for long distances, wearing poor quality footwear, and with severe bowing of the legs but no obesity. Conclusion: Lower limb musculoskeletal pain, particularly knee pain, is common in this rural Tibetan population. They live an extremely arduous life that appears to place considerable pressure on their knees. [Hoy DG, Fransen M, March L, Brooks P, Durham J, Toole MJ (2010) In rural Tibet, the prevalence of lower limb pain, especially knee pain, is high: an observational study. Journal of Physiotherapy 56: 49–54]

Key words: Lower limb, Leg, Knee, Pain, Prevalence, Rural, Tibet

Introduction

The global prevalence of chronic musculoskeletal conditions is increasing at a dramatic rate because of aging populations and considerable environmental and lifestyle changes (Woolf and Pfleger 2003). Although the Bone and Joint Decade 2000–2010, a global initiative endorsed by the World Health Organisation, is ending, there is now more than ever before a need for increased focus on musculoskeletal conditions.

Previous studies have suggested that musculoskeletal conditions are a significant problem in low-income countries, which is particularly concerning given that physical ability is inherent to livelihoods in these settings. Minh Hoa et al (2003) found a prevalence of musculoskeletal pain of 15% in urban Vietnam. Wigley et al (1994) found a prevalence of 40% in Beijing while Zeng et al found a prevalence ranging from 12% to 20% in the south of China. Similarly, Veerapen et al (2007) found a prevalence of musculoskeletal pain of 21% in 2700 semi-rural Malaysians.

When compared to high-income countries, data on musculoskeletal pain are relatively scarce in low-income countries, and studies often include younger age groups, which may mask a higher anticipated prevalence of pain in older age groups for some musculoskeletal conditions. This may partly explain why musculoskeletal conditions go largely unaddressed in these settings compared with many other conditions.

Of the musculoskeletal impairments, knee pain is one of the most common found in low-income countries (Minh Hoa et al 2003, Veerapen et al 2007, Zeng et al 2005). In high-income countries, the most probable diagnosis underlying knee pain among older people is osteoarthritis (Duncan et al 2007). Proven risk factors for symptomatic osteoarthritis of the knee include increasing age, female gender, obesity, a history of knee surgery or trauma, and having an occupation requiring heavy lifting, kneeling, or squatting (Coggan et al 2000, Felson 2004, Jensen 2008, Rossignol et al 2005).

Although they are likely to be different from those of high-income countries, there is little research on risk factors for knee pain in low-income countries. There are differences in age and gender distributions, a lower (though increasing) prevalence of obesity, a higher proportion of the population in occupations requiring heavy physical labour, and less access to health care and social welfare services. In addition, there are differences in diet and ethnicity, such as cultural variation in the way pain is perceived and linguistic variation in the way pain is defined and classified (David et al 2004, Gureje et al 1998).

The Tibet Autonomous Region is located on the Tibetan Plateau in Asia. A remote municipality known as Shigatse lies 250 km west of the capital, Lhasa. Shigatse sits 3800 metres above sea level and has a population of 85 000, of which 70% are rural. The area consists of high mountains separated by well-irrigated valleys. Villagers who inhabit these valleys are ethnic Tibetans living a subsistence way of life, which is considerably affected by poverty and poor health.

The Burnet Institute had conducted a qualitative baseline study for an AusAID-funded primary health care project.
in the rural villages of Shigatse Municipality and found musculoskeletal pain was a commonly reported problem. The study reported in this paper was in response to that baseline study. Our specific research questions were:

1. What is the point prevalence and 12-month prevalence of lower limb pain in the rural villages of Shigatse Municipality?
2. Does this differ with gender or age?
3. What factors that could contribute to lower limb musculoskeletal pain are commonly present?

### Method

#### Design

One of the authors (DH) and a Tibetan translator with sound medical knowledge initially visited three rural villages and conducted interviews, focus group discussions, and observation walks to obtain an overview of the likely extent and contributing factors of lower limb pain in these communities. Using this information, a modified version of the World Health Organisation and International League Against Rheumatism Community Oriented Program for the Control of Rheumatic Disease questionnaire was prepared with a small team of Tibetan language and health advisors (Manahan et al 1985). Prior to it being finalised, the questionnaire was pre-tested and amended through translation into Tibetan, back translation into English, and piloting in two further villages.

A modified version of the two-stage cluster sampling method was used to select 499 people from 19 rural villages. The cluster method was developed by the World Health Organisation in 1978 and is a cost-effective approach to sampling in low-income countries. Clusters are selected based on probability proportionate to the size of their population. A design effect is applied to the required sample size calculation to improve precision (Henderson and Sundaresan 1982).

In each village, a meeting was held with the village leader to explain the purpose of the visit and request permission to conduct the survey. The geographic centre of the village was identified and the village divided into quadrants. The village health worker selected the quadrant from which data were to be collected by spinning a bottle on a flat piece of ground. Households within the quadrant were numbered and the numbers placed into a hat. The health worker then randomly selected the first household to be interviewed. Once interviews within a household were complete, the next nearest household within the quadrant was selected. If an eligible person was not home, or the household had no one at home, the investigators revisited the household later in the day in an attempt to conduct the interview.

Within each house, one of the authors (DH) with the assistance of a local translator outlined the purpose of the research and explained that participation was voluntary. Following consent, participants were asked a series of questions, including: 1) ‘Do you have any leg pain at the moment?’ (current prevalence); and 2) ‘Have you had any leg pain between last harvest and now?’ (12-month prevalence) (see Appendix 1 on the eAddenda for the full questionnaire). Those who answered ‘yes’ were asked to indicate the location of their pain, which was noted by DH on a diagram of the body included in the questionnaire. The lower limb was divided into the following regions: hip, knee, ankle, foot, anterior upper leg, posterior upper leg, anterior lower leg, and posterior lower leg. A medical expert with local language skills performed monitoring visits throughout data collection to ensure questions were being translated correctly.

Then, an observation walk was conducted with the village leader and village health worker. This involved walking through the village and surrounding farmlands, and listing the presence of factors that could contribute to lower limb pain.

#### Participants

Villagers were included if they were over 15 years old. In each village, a minimum of 26 people were interviewed. If the household containing the 26th person had further eligible people, these people were also interviewed.

#### Data analysis

In order to detect a prevalence of lower limb pain of 20%, with 80% power, a p value of 0.05, and taking into account the effect of cluster sampling (design factor = 2), the required sample size was 492.

Data were analysed by calculating proportions for data not derived from simple random samples. In order to examine the pattern of lower limb musculoskeletal pain further, the group was divided by age (people aged 15 to 49 years vs those 50 years or older) and by gender. Point and 12-month prevalence were calculated for each of these subgroups. The effect of cluster sampling was taken into account when calculating the confidence intervals. Odds ratios (95% CI) were calculated for the differences between gender and age.

Information from the observation walks was grouped into common themes by the researchers, village leaders, and health workers. Factors that may contribute to the prevalence of lower limb musculoskeletal pain are reported descriptively.

### Results

#### Flow of participants through the study

In total, 499 people aged 15 years or over were interviewed across 19 villages. All people visited agreed to participate, and their characteristics are presented in Table 1. Of the participants 307 (62%) were female. The mean age of females was 43 years (SD 16) and of males was 42 years (SD 16). When stratified by decade, the most common age group was 30 to 39 years.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n = 499</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (yr), n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>15–19</td>
<td>39 (8)</td>
</tr>
<tr>
<td>20–29</td>
<td>80 (16)</td>
</tr>
<tr>
<td>30–39</td>
<td>122 (25)</td>
</tr>
<tr>
<td>40–49</td>
<td>96 (19)</td>
</tr>
<tr>
<td>50–59</td>
<td>72 (14)</td>
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<tr>
<td>60–69</td>
<td>66 (13)</td>
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<tr>
<td>70–79</td>
<td>23 (5)</td>
</tr>
<tr>
<td>80–89</td>
<td>1 (0)</td>
</tr>
<tr>
<td><strong>Gender, n female (%)</strong></td>
<td></td>
</tr>
<tr>
<td>307 (62)</td>
<td></td>
</tr>
</tbody>
</table>
Prevalence of lower limb pain

The point prevalence of lower limb pain was 40% (95% CI 34 to 46). The point prevalence of knee pain was 25% (95% CI 20 to 30) which was significantly higher than pain at any other site in the lower limb. There was no significant difference between the other sites in point prevalence of pain.

The twelve-month prevalence was only marginally higher at 48% (95% CI 42 to 54) for lower limb pain and similar at 29% (95% CI 23 to 35) for knee pain.

Prevalence of lower limb pain by gender

The odds of females having current ankle pain were 1.9 (95% CI 1.0 to 3.5) times that of males (Table 2). The odds of them reporting current foot pain were 2.3 (95% CI 1.1 to 4.9) times that of males, while the odds of them reporting posterior upper leg pain were 2.7 (95% CI 1.1 to 6.2) times that of males. The odds of females reporting pain were not more than males at the other five sites.

The odds of females having 12-month ankle pain were 1.7 (95% CI 1.0 to 3.1) times that of males (Table 2). The odds of them reporting 12-month foot pain were 2.0 (95% CI 1.0 to 4.1) times that of males, while the odds of them reporting posterior upper leg pain were 2.1 (95% CI 1.0 to 4.4) times that of males. The odds of females reporting pain at 12 months were not more than males at the other five sites.

Prevalence of lower limb pain by age

The odds of those 50 years or older reporting current lower limb pain were 4.1 (95% CI 2.8 to 6.1) times that of their younger counterparts (Table 3). The odds of those 50 years or older reporting current pain were more than the younger participants for all sites except the foot and the anterior upper leg. In particular, the odds of participants 50 years or older reporting current knee pain were 3.4 (95% CI 2.2 to 5.2) times, and current posterior leg pain were 3.2 (95% CI 1.6 to 6.2) times that of the younger participants.

The odds of those 50 years or older reporting 12-month lower limb pain were 4.0 (95% CI 2.7 to 6.0) times that of their younger counterparts (Table 3). The odds of those 50 years or older reporting 12-month pain were more than the younger participants for all sites except the foot and the anterior upper leg. In particular, the odds of participants 50 years or older reporting 12-month knee pain were 3.0 (95% CI 2.0 to 4.5) times that of the younger participants.

Factors that could contribute to lower limb pain

The observation walks revealed a homogenous population living an extremely arduous lifestyle. Adults were observed undertaking activities that involve bending of the hips, knees, and ankles, often in a weighted position. Sustained squatting was observed during activities such as toileting, clothes washing and socialising (Figure 1). We noted both men and women lifting and carrying heavy loads (eg, rocks, crops, and children), often over long distances and up and down steep terrain. Footwear was commonly poor in quality and often consisted of rubber boots or canvas shoes with little cushioning or arch support. We saw adults and children with moderate to severe bowing of the legs. We did not observe any obesity in the 19 villages visited.
Research

Table 3. Number (%) of participants for each age group with current pain (point prevalence) and pain in last 12 months and odds ratios (95% CI) between the groups.

<table>
<thead>
<tr>
<th>Site of pain</th>
<th>Groups</th>
<th>Difference between groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current pain</td>
<td>Pain in last 12 months</td>
</tr>
<tr>
<td></td>
<td>≥ 50 yr (n = 162)</td>
<td>&lt; 50 yr (n = 337)</td>
</tr>
<tr>
<td>Lower limb</td>
<td>102 (63)</td>
<td>99 (29)</td>
</tr>
<tr>
<td>Hip</td>
<td>18 (11)</td>
<td>16 (5)</td>
</tr>
<tr>
<td>Knee</td>
<td>66 (41)</td>
<td>57 (17)</td>
</tr>
<tr>
<td>Ankle</td>
<td>27 (17)</td>
<td>26 (8)</td>
</tr>
<tr>
<td>Foot</td>
<td>17 (11)</td>
<td>23 (7)</td>
</tr>
<tr>
<td>Anterior upper leg</td>
<td>10 (6)</td>
<td>13 (4)</td>
</tr>
<tr>
<td>Anterior lower leg</td>
<td>25 (15)</td>
<td>20 (6)</td>
</tr>
<tr>
<td>Posterior upper leg</td>
<td>17 (11)</td>
<td>18 (5)</td>
</tr>
<tr>
<td>Posterior lower leg</td>
<td>22 (14)</td>
<td>16 (5)</td>
</tr>
</tbody>
</table>

Discussion

The point prevalence of musculoskeletal lower limb pain in this rural Tibetan population was 40% (95% CI 34 to 46), which is higher than that in some low-income countries (Minh Hoa et al 2003, Veerapen et al 2007, Zeng et al 2005). The knee was by far the most common site of pain, followed by the ankle and the hip. Furthermore, the prevalence of current knee pain in those over 50 years was 41% (95% CI 30 to 52) even though we observed no obesity in this population.

Although it is difficult to compare the prevalence of knee pain across studies due to heterogeneous methods, the prevalence of knee pain in this low-income country appears high compared with populations in high-income countries (Andersen et al 1999, Cecchi et al 2008, Dawson et al 2004, Keenan et al 2006, Urwin et al 1998). In addition, an overview of studies that have taken place in low-income countries since 1983 estimated the one-week prevalence of knee pain in people 15 years and over to be 14% (Davatchi 2006), whereas the point prevalence of knee pain in our cohort was substantially higher at 25% (95% CI 20 to 30).

A possible explanation for the high prevalence of knee pain found in our study may be the large amount of squatting and lifting (Cozzensa da Silva et al 2007) and climbing up and down steep terrain that was observed. Previous studies have suggested that squatting and excessive loading on the knee over long periods is a risk factor for knee osteoarthritis (Hurwitz et al 2000, Miyazaki et al 2002, Tangtrakulwanich et al 2007). Stair climbing has been shown to generate high forces and torques in the patellofemoral joint, increasing the risk of painful osteoarthritis in this joint (Hunter et al 2007). Similarly, a study in China found a 4% higher age-adjusted prevalence of knee pain in people living in multi-storey buildings without elevators compared with those living in single-story buildings ($p < 0.01$) (Zeng et al 2005).

Dietary deficiencies may also explain the high prevalence of knee pain. Kashin-Beck disease, which causes restriction of movement and joint deformity, is endemic to Tibet and associated with low socioeconomic status, poor diet, and iodine deficiency (Suetens et al 2001, Yang et al 2002). Rickets (Vitamin D and calcium deficiency in children), which often results in substantial varus malalignment of the knee (Cerejo et al 2002), is also common in this region, and may contribute to the presence of knee pain (Harris et al 2001). Another factor contributing to the high prevalence of knee pain could simply be the lack of access to health care. For example, knee replacement surgery for severe knee osteoarthritis is not an option in rural Tibet.
Consistent with reports from other Asian and low-income countries, this study found a higher knee-to-hip pain ratio than that found in high-income countries (Davatchi 2006, Nevitt et al 2002). The ratio was 3.6:1 in this Tibetan population and 4.7:1 in the overview of studies in low-income countries since 1983 (Davatchi 2006). In contrast, the ratio ranged from only 1.4:1 to 2:1 in Hungary and the UK (Dawson et al 2003, Horvath et al 2006, Urwin et al 1998). The lower prevalence of hip pain relative to knee pain in the rural Tibetan population may be due to a lower prevalence of rheumatoid arthritis, slipped capital femoral epiphysis, Perthes disease, and obesity (Lau et al 1995). While spending hours squatting is thought to be a risk factor for chronic knee pain, it has also been hypothesised that it may protect against hip pain in Asian countries (Lau et al 1995). Further research would shed light on this.

The study was conducted in autumn, a time of year following a period of reduced physical activity. This timing may have resulted in a lower point prevalence of musculoskeletal pain than if it had been conducted during colder months or busier times of the year. On the other hand, anecdotal evidence suggests that some respondents may be more encouraged to report pain if they think that it will result in free medication or other health care. We attempted to address this concern by clearly informing potential participants that no medication would be distributed and all villagers would receive feedback and education regardless of their response.

Finally, this study used rigorous sampling techniques to demonstrate a high prevalence of knee pain in a geographic region where little is known about musculoskeletal impairments. Given the extent to which the majority of this population rely on good physical function to maintain their livelihoods, the high prevalence of knee pain is of great concern. Further research is needed to deepen our understanding of both cultural and environmental factors involved in the pathogenesis of musculoskeletal pain.

eAddenda: Appendix 1 available at www.JoP.physiotherapy.asn.au

Ethics: The study was approved by the Standing Committee on Ethics in Research on Humans at Monash University, Australia. Informed consent was obtained before data collection began.

Competing interests: There were no competing interests in this study.

Support: The study was supported by the Rotary Club of Bundoora; J Walter Thompson Australia; and the Australian Agency for International Development (AusAid). The sponsors of the study had no role in the study design, data collection, data analysis, data interpretation, or writing of the paper.

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