School Screening For Musculo-Skeletal Deformities in the Eastern Province, Saudi Arabia

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ABSTRACT

Patients with advanced musculo-skeletal deformities are seen frequently in orthopaedic clinics in Saudi Arabia. Early detection and treatment, combined with public health education, would prevent this situation. In this study 26,662 school children from 28 schools in four districts of the Eastern Province of Saudi Arabia were screened for musculo-skeletal deformities by purpose-trained screeners. Supervision of these screeners and quality control visits was undertaken by consultants. 630 children (2.4%) with 847 musculo-skeletal disorders were identified and referred for specialists' re-evaluation. Of these disorders 155 (18.3%) were clinically significant: 18 kyphoses, 66 scolioses, 23 with limp, 11 club feet, 21 elbow and 16 finger deformities. This prevalence of musculo-skeletal disorders highlights the need for large-scale screening. We therefore recommend that this becomes routine for school children, and that regional screening teams be established.

Patients with musculo-skeletal deformities are seen frequently in the King Fahd Hospital of the University and include those resulting from poliomyelitis, cerebral palsy, scoliosis and injuries[1]. Many are young but their deformities are often in the late clinical stages. Although prevention is not always possible, early detection is feasible and would lead to effective treatment and an improved quality of life. Scoliosis is a case in point. Untreated scoliosis deforms young adults and can shorten life expectancy[2-5]. If detected early, it can be treated by bracing[6,7]. However, when detected late, expensive surgery is required with associated morbidity[1,8-10]. Early detection can be achieved by screening school children and increasing public awareness.

Most school screening programmes in developed countries focus on scoliosis[11,12]. Why then did we enlarge our scope to include other musculo-skeletal deformities? In a pilot study involving 2,209 school children, 177 were found to have other deformities which otherwise would have gone undetected[13].

The aims of this study were to undertake:

1) early detection of musculo-skeletal deformities in school children
2) referral of affected children for treatment
3) epidemiological studies
4) public health education on the problem.

METHODS

The target population was school children in four districts – Dammam, Khobar, Hassa and Qateef, which, with two genders, yielded eight sampling strata. Fourteen boys' and 14 girls' schools were selected from each stratum and nine classes from each school; 25 students were covered in each class. It was estimated that 4,880 was the minimum sample size required to evaluate the rate of musculo-skeletal deformities with an error of 1% unit at the 99% confidence level; at the 95% confidence level it was 2,828.

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A sample size of 25,000 children was therefore considered appropriate.

A total of 120 visits were made and a further 15 allowed for quality control study (QCS) wherein 1,435 children were re-examined by consultants. Children with definite or suspected deformities were referred to a review clinic.

Height and weight were measured, and gait inspected. The spine was examined in the erect posture and the forward bending test for scoliosis was performed[14]. Lower limbs were examined for shortening, wasting, club feet, fused or curly toes and amputations as well as genu valgus/varus and flat-feet. Upper limbs were examined for wasting, elbow valgus/varus, hand, finger and other deformities[15]. Examination took approximately one minute per child.

We defined Dammam and Khobar as urban areas, Hassa and Qateef as rural. Computer programmes used were "SPF-PC+" and "SPSS-PC+" for descriptive statistics, chi-square and Fisher's exact test as appropriate. Comparisons were made under five variables: age, sex, nationality, school level and district. Details of scoliosis and upper limb deformities have already been reported[14,15].

Table 1
Distribution of 26,662 school children screened by four basic variables

Variables	*Number*
School District	
– Dammam	6716
– Khobar	6834
– Hassa	6788
– Qateef	6324
Nationality	
– Saudi	23196
– Non-Saudi	3466
Sex	
– Males	13250
– Females	13412
School Level	
– Elementary	20263
– Intermediate	6399

In this article, we focus on the overall benefits and recommendations of the school screening programme, as well as details of kyphosis and lower limb deformities.

RESULTS

A total of 26,662 children were screened. Table 1 (above) shows their distribution by district, nationality, sex and school level; 87% were Saudis and 76% were in the elementary grade.

Table 2
Distribution of kyphosis & scoliosis by age group, nationality, sex & school level

Variables	*Kyphosis*	*Scoliosis*
Age group		
<10	3	21
10 - 15	11	30
>15	4	15
Nationality		
Saudi	14	56
Non-Saudi	4	10
Sex		
Boys	12	22
Girls	6	44
School level		
Elementary	12	40
Intermediate	6	26

Table 2 shows the breakdown of spinal deformities by age group, nationality, sex and school level. The prevalence of kyphosis was 68 per 100,000. When computed according to district, the prevalence was 15,44,63 and 147 per 100,000 in Dammam, Khobar, Qateef and Hassa respectively . The difference between the urban vs rural districts was statistically significant (p=0.03). Of the 18 kyphotics, seven reported to the review clinic; four of the "no shows" were subsequently seen in school when the quality control sample was examined.

Sixty-six children with scoliosis were detected, a prevalence of 248 per 100,000. Whereas there were no differences in age group, nationality and school level, the differences between sexes, and rural vs urban districts, were significant[14].

Table 3
Distribution of nine types of lower limb deformities by age, sex and school level

Deformity	*Limp*	*Short-ening*	*Muscle wasting*	*Knock knee*	*Bow legs*	*Club foot*	*Flat foot*	*Fused toes*	*Others*
Age groups									
<10	6	4	1	16	14	2	37	6	28
10-15	12	16	13	23	72	7	92	8	66
>15	5	8	6	10	48	2	46	2	31
Sex									
Boys	10	10	—	9	20	8	98	6	—
Girls	13	18	—	40	114	3	77	10	—
School level									
Elementary	17	20	—	31	46	8	114	13	84
Intermediate	6	8	—	18	88	3	61	3	41

Table 3 is a breakdown of lower limb deformities according to age group, sex and school level. Comments are made only if differences had attained statistical significance. The prevalence of limb deformities was significantly different in Dammam, Khobar, Qateef and Hassa (p=0.002).

The differing prevalence of muscle wasting per age group was statistically significant ($p < 0.004$). The prevalence for knock knee showed significant difference between districts (p=0.0001); and more girls than boys had this deformity (p=0.0001). With bow legs, flat feet and "others", differences were significant in relation to district (p<0.0001) and age groups (p=<.001). Limp, shortening and wasting were significantly more frequent in rural than urban areas (p=0.003, 0.01 and 0.0006 respectively); but the reverse was true for knock knee, bow legs and flat feet.

The mean compliance rate for lower limb deformities was 32.3% (range 20% to 45% for club feet). The specificity of screening for lower limb deformities alone was 97% which meant that children with normal lower limbs had been successfully screened out.

A total of 182 children had upper limb deformities, a prevalence of 683 per 100,000, the details of which have already been reported[15].

DISCUSSION

Of 26,662 school children screened, 630 (2.4%) were found to have 847 different musculo-skeletal deformities. Twelve boys and six girls had kyphosis (Table 2). There was a significantly higher prevalence in Al-Hassa. Aetiology needs to be determined before conclusions can be drawn. Of the seven who came to the referral clinic, six were normal and one had Schuermann's disease and has since been braced. The measure of specificity was 99.7% indicating that there were very few false positives in the test sample of 1,435 cases. This would suggest that the method of visual screening adopted was adequately specific. However, the measure of sensitivity was not reliable because the number of cases with kyphosis was small compared with the sample.

At first glance, it would seem that screening for kyphosis does not justify cost. However, the ethical consideration cannot be ignored. The single case of Schuermann's disease detected has been treated and his future outlook is good. Furthermore, screening for kyphosis adds no more than 10-15 seconds to the process and we recommend it along with screening for scoliosis, details of which have been reported previously[14]. Prevalence was much lower than in reports from the West[11,20-22].

Limp, shortening and wasting in the lower limb were identified separately as they could result from causes such as poliomyelitis, congenital dislocation of the hip and trauma. However, all the true positive cases detected were due to poliomyelitis; hence the results of the three categories are grouped together.

The prevalence of limp and shortening showed statistically significant differences between districts.

Al-Hassa and Qateef where the prevalence was highest are more rural with centralised health care facilities. Al-Hassa is also a much wider geographic area compared with the others. It is likely therefore that immunisation programmes against poliomyelitis had been less effective. Shortening and wasting were significantly associated with age, especially in the over 15 age group. This finding again suggests the likelihood of inadequate immunisation programmes in infancy. Conversely, low prevalence in the younger children is encouraging and can be attributed to the increasing availability of health facilities and successful immunisation programmes. It also stresses that there is no room for complacency as the WHO now regards poliomyelitis as an eradicable disease[19].

The prevalence of knock-knee was significantly lower in Qateef and significantly higher among girls. These findings suggest that further study of this condition, which can predispose to osteoarthrosis in adult life, would be worthwhile with emphasis on congenital, environmental and sex-linked factors.

Of the 11 children with club feet, five reported to the review clinic and four have had corrective surgery. The detection and treatment of club foot has been a particularly rewarding aspect of the project.

The compliance rate of referrals to the review clinic for lower limb musculo-skeletal deformities was variable. In cases of fused toes, 80% failed to show up. Screening for such a disorder in the future would not be worthwhile. Of greater importance was the fact that 54.5% with club feet and 63.7% with limp, shortening and wasting also failed to report to the referral clinic.

The specificity of testing for lower limb deformities ranged from 97.6 to 99.7% in the QCS. This indicated that criteria used for diagnosis were acceptable. Figures for sensitivity are less reliable because of the small number of true positives.

Details of upper limb deformities have been reported previously[15]. Prevalence was highest in Hassa, a rural agricultural area.

In general, the compliance rate of detected cases to attend the referral clinic was poor. Four additional steps were taken to track down the referred children who did not show up. Thus, when consultants visited schools in the QCS, known positive cases were called up, the schools' principals were given the names of "no-shows" for recall, and the schools' medical officers were requested to "follow-up". Finally, referral clinics were kept open at week-ends for ease of access.

In the 847 suspected musculo-skeletal deformities detected, 84 affected the spine, 581 the lower limbs and 182 the upper limbs. It would be useful to know the proportion of the above who benefited from referral to the specialist clinic. Unfortunately the poor compliance rate makes it difficult to draw general conclusions. However, of those who attended, 24 underwent surgery, 33 are on the waiting-list for surgery, 28 are being followed up in the clinic and 37 true positives have been discharged after receiving medical advice and guidance.

There were additional gains from the project. First, 26,662 children in the Eastern Province have been examined for musculo-skeletal deformities by qualified personnel at no cost to themselves. Children detected with disorders such as progressive scoliosis have undergone corrective surgery. Secondly, public awareness of problems such as scoliosis has increased. Finally, the programme was instructive for school teachers, students and parents.

In view of the benefits which accrued from this screening programme, should we screen for musculo-skeletal deformities in schools on a national scale? This issue must be viewed in a correct perspective[20-24]. Whereas screening for scoliosis is compulsory in Japan and in some states in the USA[20], in Britain the issue is still being debated[21-23]. Dickson feels that increasing public awareness rather than school screening is where resources should be directed[20]. The cost of the programme and the diverting of physicians away from their other clinical commitments are factors to be considered. Our broad study embracing musculo-skeletal disorders detected a rate of approximately 1,000 per 100,000 screened.

CONCLUSION

School screening for musculo-skeletal deformities in Saudi Arabia is worthwhile at present. However, it must be linked directly to a hospital referral system so that detected cases can be evaluated and treated where indicated. Unless this service aspect is available, screening becomes a worthless exercise. Also, further epidemiological study of musculo-skeletal deformities is recommended specifically for scoliosis and bow legs in the Eastern Province and in other regions of the Kingdom.

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