

Clinical Study

A population-based cohort study of 394,401 children followed for 10 years exhibits sustained effectiveness of scoliosis screening

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Abstract

BACKGROUND CONTEXT: The value of scoliosis screening has been recently shown in a multicenter randomized controlled trial. However, the long-term sustainability of the clinical effectiveness of scoliosis screening as a routine health service remains unknown.

PURPOSE: The aim of this study was to assess the sustainability of the clinical effectiveness of school scoliosis screening.

STUDY DESIGN/SETTING: A large population-based cohort study with a 10-year follow-up was conducted.

PATIENT SAMPLE: A total of 394,401 students who were in the fifth grade during the five academic years from 1995/1996 to 1999/2000 formed five consecutive annual cohorts. The students were eligible for the Hong Kong scoliosis screening program, with their screening history and medical records until their nineteenth birthdays being assessed.

OUTCOME MEASURES: The outcome measures considered in the study were development of adolescent idiopathic scoliosis by the 19 years of age and the Cobb angle.

METHODS: The clinical effectiveness of scoliosis screening was assessed by referral rate for radiographic diagnosis, sensitivity, specificity, and predictive values.

RESULTS: A total of 306,144 students (78%) participated in scoliosis screening, which used a two-tier system. The prevalence of curves of 20° or greater was 1.8% (95% confidence interval [CI], 1.7–1.8%), whereas the referral rate for radiography, the sensitivity, and the positive predictive value (PPV) for curves of 20° or greater were 4.1% (95% CI, 4.0–4.2%), 91% (95% CI, 90–92%), and 40% (95% CI, 39–41%), respectively. Across the five consecutive annual cohorts, the prevalence and sensitivity for curves of 20° or greater increased by 0.23% (95% CI, 0.21–0.25%; $p < .001$) and 0.76% (95% CI, 0.43–1.04%; $p < .001$) per year, respectively; however, the PPV was reduced by 1.71% (95% CI, 1.09–2.33%; $p < .001$) per year.

FDA device/drug status: Not applicable.

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CONCLUSIONS: This report describes the first large population-based study with a long-term follow-up indicating that a scoliosis screening program can have sustained clinical effectiveness in identifying patients with adolescent idiopathic scoliosis needing clinical observation. As the prevalence of adolescent idiopathic scoliosis increases, scoliosis screening should be continued as a routine health service in schools or by general practitioners if there is no scoliosis screening policy. © 2015 Elsevier Inc. All rights reserved.

Keywords: Adolescent idiopathic scoliosis; Clinical effectiveness; Health services; Retrospective cohort; Scoliosis screening; Sustainability

Introduction

School scoliosis screening has been used to identify individuals with adolescent idiopathic scoliosis (AIS) who require clinical follow-up or conservative brace treatment, with an aim of reducing the risk of requiring invasive spinal fusion surgery [1]. However, despite its long history of more than 60 years, its use as a routine health service has been heavily debated [2]. In 2004, the US Preventive Services Task Force recommended against scoliosis screening as a routine health service, primarily because of the lack of effective screening tools and inadequate evidence supporting that bracing AIS patients reduces the risk of progression and hence the need for surgery [3]. This finding led to the abolishment of screening programs or reduced enthusiasm toward scoliosis screening around the globe [4]. However, a recent multicenter randomized controlled trial has shown that brace treatment can effectively reduce the risk of progression of AIS at skeletal maturity [5]. This confirms the value of scoliosis screening for the early detection of AIS [6].

The clinical effectiveness of scoliosis screening has been assessed in numerous studies of different designs, which have been synthesized in a systematic review and a meta-analysis [7,8]. The systematic review covered 28 studies published between 1977 and 2004 and concluded that there was sufficient evidence to suggest that school scoliosis screening is safe, may detect cases of AIS at early stages, and may reduce the risk of surgery [7]. In contrast, the aforementioned meta-analysis focused on 36 retrospective cohort studies that were published from 1977 to 2005 and concluded that there was substantial heterogeneity across the studies, that the use of the forward bending test alone is inadequate, and that there is a need for a large retrospective cohort study with sufficient follow-up [8]. To address this challenge, a large population-based retrospective cohort study was later conducted that followed 157,444 students from the age of 10 years until they were 19 years old who were diagnosed with scoliosis via a two-tier screening protocol in Hong Kong [9]. The results showed that the program was clinically effective in detecting significant curves, with a low referral rate for radiography and with a cost that was close to or lower than other scoliosis screening programs [9–11]. This new evidence initiated a review of the best available evidence by an international

task force, which concluded that there is scientific evidence to support the technical efficacy and the clinical, program, and treatment effectiveness of scoliosis screening [6].

However, no previous studies have assessed the sustainability of the clinical effectiveness of scoliosis screening protocols. Sustained effectiveness is a critical issue and a challenge for community health service initiatives [12]. A screening program may be highly effective when first implemented, but its clinical effectiveness may decrease as its duration increases [13]. Inadequately designated fiscal resources, the reduced enthusiasm of the staff, unsystematic skills training, poorly articulated visions of aims and goals, and a lack of support from policy makers are some of the factors that may weaken the effectiveness of a community program over time [12].

In Hong Kong, scoliosis screening has been conducted as a routine health service since 1995, thereby making it one of the regions with the longest history of routine scoliosis screening in the world. Hong Kong's screening protocol was demonstrated to be clinically effective for children who studied in the fifth grade during the first two academic years after the program was started; however, no longer term evaluation was attempted [9,14]. Therefore, the aim of this study was to build on our previous work to assess the sustainability of the clinical effectiveness of scoliosis screening in a community setting for a longer follow-up period by follow-up of the children through their academic years until they reached an age of 19 years.

Materials and methods

This study was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (UW 09-113).

Study design

We conducted a population-based cohort study of students who were in the fifth grade during the academic years 1995/1996 to 1999/2000. Medical records, which included their screening history for scoliosis until they reached an age of 19 years, were retrieved. Ethics approval was obtained from the local authority.

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