



# BACK HEALTH

## Scoliosis Screening: A Review of Current Evidence, Worldwide Practices, and Recommendations for Implementation Across Canada

### ABSTRACT

There is a lack of consensus about the merits of scoliosis screening and whether it is a beneficial strategy for both the patients and the healthcare system. With mounting concerns about long wait times across Canada for surgical correction of scoliosis, interest has grown in maximizing non-operative care. We have investigated the history of scoliosis screening and the controversies surrounding implementation of screening in a Canadian setting. We propose an optimal screening strategy.

**KEYWORDS:** Scoliosis, scoliosis screening, early detection, conservative strategies



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Pre-test Quiz



### Introduction

The Canadian media has recently brought attention to the long wait times for the diagnosis and surgical treatment of scoliosis.<sup>1-3</sup> Early diagnosis provides opportunities for conservative strategies, such as scoliosis-specific physiotherapy and bracing, which may reduce the number of children requiring an operation.<sup>4</sup> For those patients who need surgery, increased wait times can have significant negative consequences, including increasing curve size while awaiting correction, the necessity for



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an anterior release, longer surgeries, greater blood loss, and longer postoperative stays.<sup>5</sup> According to CTV News, four in ten children in Canada do not receive corrective surgery within the recommended 6-month period. This delay costs the Canadian healthcare system an estimated \$44.6 million annually.<sup>3</sup>

Over the years, school screening for scoliosis has gained and lost popularity in various countries.<sup>4</sup> In Canada, school scoliosis screening programs were implemented in the 1970s but, due to insufficient supporting evidence, the mandate was lifted in the 1980s.<sup>6,7</sup> Since then, the prevalence of screening has decreased and in 2003 the nationwide screening programs came to an end.<sup>6,8</sup> The Canadian Task Force on Preventive Health Care has not updated its recommendation since 1994, and scoliosis screening is not listed in the guidelines for preventative measures.<sup>7</sup> Despite this, Nova Scotia has shown renewed interest in reinstating the procedure.

Compared to tropical countries, the warm clothing necessitated by Canada's climate may limit the casual recognition of scoliosis and increase the need for school screenings. Because adolescents typically wear clothing that hides the deformity, parents often express guilt over missing the child's curve. Many patients already have curves in the surgical range before the deform-

ity is detected by their family and brought to the attention of healthcare providers. It is well-documented that timely bracing can significantly decrease the progression of high-risk curves in patients with adolescent idiopathic scoliosis (AIS).<sup>4,9-11</sup> If these curves are detected sooner, bracing could potentially decrease the need for surgery.

### General Principles of Treatment

Treatment options for scoliosis vary depending on patient age and severity of the curve. Physiotherapy is generally indicated for scoliosis patients with a Cobb angle between 20 and 45 degrees, and has been demonstrated to assist in slowing curve progression and decreasing curve magnitude.<sup>12</sup> Bracing with a thoracolumbar spinal orthosis (TLSO) has also been shown to prevent curve progression and need for surgery, and can be used in patients with Cobb angles ranging from 20 to 45 degrees.<sup>9</sup> The brace should ideally be worn 18 to 23 hours a day and be used until the patient has finished growing. Other bracing options exist including night-time bending braces that can be used independently or in combination with a TLSO.

Because a curve greater than 45 or 50 degrees is expected to continue to progress into adulthood, surgery is typically recommended. Posterior spinal

instrumented fusion is the most common surgical approach. This involves the use of screws and rods to correct the deformity and achieve a fusion that will prevent curve progression. For younger patients with ongoing growth potential, several surgical approaches exist to allow correction, while allowing growth to continue. Examples of growth-friendly options include distraction-based constructs such as growing rods and vertical expandable prosthetic titanium rib (VEPTR), guided-growth techniques (Luqué trolley or the Shilla system), and growth-modulation options such as staples and anterior vertebral body tethering. Regardless of surgical option, these procedures are invasive and costly, so strategies to help prevent curve progression and the need for deformity surgery are obviously beneficial both to patients and the healthcare system.

### **Scoliosis Screening**

Screening to determine if a child has scoliosis may be performed by health care providers or lay people trained in screening techniques.<sup>13</sup> The goal is early detection that provides an opportunity to prevent curve progression.<sup>13</sup>

There are numerous methods of scoliosis screening. The forward bending test (FBT) is a simple and quick test where the child is asked to bend forward so that the examiner, looking from

behind, can determine if there are irregularities or asymmetry in the child's back, ribs, and shoulders. An examiner can use a scoliometer to measure the angle of trunk rotation (ATR) by placing the instrument on the child's back while they are bent forward.<sup>7,14</sup> Another screening method is Moiré topography, where the examiner uses a light-projecting device to project a series of lines, creating a topographical map on the child's back. Asymmetries observed in the map can be indicative of scoliosis. A humpometer is another screening tool. It involves placing a series of flexible strips on the child's back. Once these strips take the shape of the back they are linked together, removed and their shape traced onto paper to determine asymmetry.<sup>7</sup> Technological advances in smartphone use for screening are in development phases but are not yet ready for widespread use. There are new 3D surface topography applications found on the web. Screening should employ a combination of these tests to increase accuracy.<sup>7</sup>

### **Scoliosis Screening in Schools**

The arguments for school screening include the early detection of scoliosis and early intervention with treatment strategies such as physiotherapy and bracing.<sup>3,10</sup> This could potentially reduce the number of children requiring surgery and, in turn, decrease surgical wait



times for those who do need an operation.<sup>3</sup> In addition, early diagnosis can lead to intervention on a less complex curve, allowing for less invasive surgery.<sup>15,16</sup> Generally, school screenings are associated with low costs.<sup>10,17</sup>

On the negative side, there is the risk of false positives and overdiagnosis, leading to needless costs and potentially unnecessary x-rays.<sup>14,16,18,19</sup> Increased referrals to spine surgeons could overwhelm an already strained medical system, further prolonging wait times for children who more urgently need to be seen.<sup>3</sup> Labeling young patients with scoliosis can have negative psychological effects, potentially causing anxiety and self-esteem issues.<sup>4</sup> The movement towards person-centered care emphasizes shared decision-making, which school screenings might undermine by not involving the child and their family in the initial detection process.

### **Current State of Scoliosis Screening Globally**

Recommendations for scoliosis screening programs vary worldwide and have changed over time. School screening is not currently implemented in Australia, Denmark, or Norway.<sup>20</sup> The United Kingdom National Screening Committee does not endorse scoliosis screening due to concerns about over-detection and wasting resources.<sup>21</sup> China reports a low prevalence of scoliosis screening, with rates ranging from 2.4-3.9% in eastern China to 3.69-10.8% in western China.<sup>22</sup> In 2004, the United States Preventive Task Force recommended against scoliosis screening but in 2018 they updated their recommendation to “inconclusive”.<sup>7,20,21</sup> Since there is no nationwide policy, the prevalence of scoliosis screening programs varies from state to state and school to school, but is generally low. In a study conducted in 2015-16, 7.2% of schools in Louisiana had scoliosis screening programs in place.<sup>13</sup>

In 2013, a US population-based study to investigate 20-year trends in the incidence of adolescent idiopathic scoliosis was completed. The study assessed 1,782 adolescents with an annual incidence of AIS at a rate of 522.5 per 100,000 person-years.<sup>23</sup> In 2004, after scoliosis screening was discontinued, the incidence rate of AIS substantially decreased and the authors reasonably proposed that fewer patients were diagnosed due to the cessation of school screening.<sup>23</sup> Another study conducted from 1979-1982 in the US evaluated the efficiency of adolescent scoliosis screening and found that 448 children were screened in order for one child to be diagnosed with scoliosis.<sup>24</sup>

Despite the generally low rates of scoliosis screening, medical associations such as the Scoliosis Research Society, the American Academy of Orthopedic Surgeons, the International Society on Sco-

liosis Screening, and the Pediatric Orthopedic Society of North America support school scoliosis screening programs for the early identification of adolescent idiopathic scoliosis.<sup>21,22</sup> In Singapore, screening for scoliosis has been routinely conducted since 1981, as part of their national school health screening program.<sup>4</sup> Belgium, Croatia, Cyprus, Malta, Slovenia, and Sweden have standard school screening while Bulgaria, Greece, Italy, the Netherlands, Spain, and Turkey have optional programs.<sup>6,20</sup>

### Current State of Scoliosis Screening in Canada

Currently, Canada does not have a nationwide school screening program for scoliosis. The Canadian Task Force on Preventive Health Care's last recommendation on scoliosis screening dates back to 1994, citing insufficient evidence to support or oppose the practice. As a result, scoliosis screening in schools is not standardized and is often dependent on individual school boards or provincial health policies.<sup>6</sup>

In some provinces, like Ontario, scoliosis screening is occasionally performed by school nurses or public health officials, but these efforts are not consistent. Most scoliosis cases are identified through routine physical examinations by family doctors or during paediatric check-ups when symptoms become noticeable. This lack of a structured screening program

means many cases go undetected until the curves are too great, or the patients are too skeletally mature for bracing, necessitating surgical intervention.<sup>6</sup>

The Canadian Paediatric Society (CPS) has acknowledged the debate over school screenings but has not taken a definitive stance, emphasizing the need for more research to determine the effectiveness and cost-benefit ratio of such programs. In contrast, advocacy groups and some healthcare professionals argue for the reintroduction of regular school screenings since early detection should reduce the burden on the healthcare system.<sup>4</sup>

### Authors' Recommendations

While concerns about school scoliosis screenings are valid, they can be effectively addressed with thoughtful strategies. To maintain a people-centered approach, families should be able to opt into the screening program, ensuring that participation is voluntary and in line with their preferences.

To mitigate additional strain on the medical system, if school screening identifies a curve, families should be instructed to follow up with their primary care provider. The provider can then determine the necessity of imaging, and only appropriate cases would be referred to specialist centres for further evaluation. These specialist centres often employ a triage system to ensure that unnecessary

referrals are minimized, preventing undue strain on specialist services. The number of physiotherapist and nurse practitioner-led clinics are increasing across the country and should distribute the workload more evenly, reducing the burden of increased referrals while maintaining a lower cost.<sup>25</sup>

Concerns about overdiagnosis and the psychological impact of labeling children can also be mitigated. Screening clinics should avoid diagnostic labels and families should receive only a recommendation for further assessment by their primary care provider.

Minimizing unnecessary radiation is essential, but it must be remembered that a single chest x-ray constitutes only 1/20th of the annual recommended radiation limit.<sup>26</sup> This low level of exposure can be considered safe, especially when balanced against the benefits of early scoliosis detection. The screening x-rays should be read by an experienced radiologist. In the past, variability in deformity measurement has been sufficient to misdiagnose in one in four x-rays.<sup>27</sup>

Finally, the belief that only curves over 50 degrees progress into adulthood may not be valid. Recent research indicates that curves over 30 degrees may also progress, albeit at a slower rate.<sup>28</sup> This underscores the importance of detecting mild curves early to enhance the overall effectiveness of scoliosis management and prevention strategies.

Canada-wide Consensus

Given the significant impact of scoliosis on children’s health and the Canadian healthcare system, there is a compelling case for reconsidering the implementation of Canadian school screening programs. Early detection through school screenings could improve access to timely interventions, reducing the need for surgery and their associated healthcare costs. Even though concerns about overdiagnosis and resource allocation remain valid, these can be mitigated with well-designed protocols and proper training for screeners.

This paper advocates for a renewed, evidence-based approach



SUMMARY OF KEY POINTS

Screening can facilitate early diagnosis and treatment of scoliosis.

Early diagnosis of scoliosis increases opportunities for successful conservative treatment.

Conservative strategies may prevent the need for surgical intervention.

Scoliosis screening may improve access to care and reduce health care costs.

to scoliosis school screenings in Canada. We believe that this will greatly assist Canadian children with scoliosis to receive timely and appropriate care, ultimately improving outcomes and reducing the long-term costs associated with delayed treatment.

After a comprehensive review of the current literature, global practices, and the state of scoliosis screening in Canada, we propose the following consensus statements to guide the implementation of a nationwide scoliosis school screening program:

**1. Necessity for Early Detection:** Early detection of scoliosis

through school screenings is recommended for initiating timely and effective conservative treatments, such as bracing and physical therapy. This can significantly reduce the need for surgical interventions and associated healthcare costs.

**2. Standardized Screening Protocols:** A standardized, national, evidence-based screening protocol should be developed and implemented across all Canadian schools. This protocol should include clear guidelines on the use of screening tools, referral criteria, and follow-up proce-



## CLINICAL PEARLS

Early detection of scoliosis through school screenings is recommended for initiating timely and effective conservative treatments, such as bracing and physical therapy. This can significantly reduce the need for surgical interventions and associated healthcare costs.

A standardized, evidence-based screening protocol should be developed and implemented across all Canadian schools. This protocol should include clear guidelines on the use of screening tools, referral criteria, and follow-up procedures to ensure consistency and accuracy in detecting scoliosis.

School nurses, physical education teachers, and other relevant personnel should receive adequate resources and support for proper training in scoliosis screening.

Educational campaigns must raise awareness about the signs of scoliosis and the importance of school screenings for early detection among parents, teachers, and the general public.

Ongoing research and evaluation of the screening program should be conducted to assess its effectiveness, cost-benefit ratio, and impact on health outcomes.

Collaboration between healthcare providers, educators, policymakers, and scoliosis advocacy groups is essential to create a comprehensive and sustainable screening program.





CME

## Post-test Quiz

Members of the College of Family Physicians of Canada may claim MAINPRO-M2 Credits for this unaccredited educational program.

dures to ensure consistency and accuracy in detecting scoliosis.

### 3. Training and Resources:

School nurses, physical education teachers, and other relevant personnel should receive proper training, adequate resources and support to conduct accurate, and efficient scoliosis screenings. As technology improves, smart-phone use, either in schools or at home, may become part of a screening protocol.

### 4. Public Awareness and Education:

Raising awareness about scoliosis and the importance of early detection among parents, teachers, and the public is crucial. Educational campaigns should be implemented to inform communities about the signs of scoliosis and the benefits of school screenings.

### 5. Research and Evaluation:

Ongoing research and evaluation of the screening program should be conducted to assess its effectiveness, cost-benefit ratio, and impact on health outcomes. This will ensure that the program remains up to date with the latest scientific evidence and best practices.

### 6. Collaborative Approach:

Collaboration between health-care providers, educators, policymakers, and scoliosis advocacy groups is essential. This multidisciplinary approach will help address potential challenges and improve the overall success of the program.

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