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An AI-based System for Determining Risk of Acquiring Scoliosis in School-Age Children

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Abstract – In this paper, the authors discuss the implications of scoliosis (lateral curvatures and rotations of the human spinal column) on the minds and the bodies of school-going children. Scoliosis is a body-disfiguring disease, which affects vital organs. This condition grows silently without any associated pain (hence often remains hidden) and can be detected only during an unclothed physical examination. It is imperative that, during such an examination, Differential-Spinal-Function Testing (DSFT) be conducted to rule out scoliosis-like conditions. In order to understand the etiology of scoliosis, one needs to learn anatomy of the human-spinal column. The authors, briefly, describe 2-D and 3-D models developed during the period of half-a-century. A system for assigning risk (low, medium, high) of suffering from scoliosis by school-age children was developed by the NGDS Team, in order to plan an efficient and an effective case-finding strategy. Such a system, involving human interface (examining physician), has been in place since 2020 and an enhancement of the system is being worked out. Cumulative-Scoliosis-Risk Weightage (CSRW) and Normalized-Scoliosis-Risk Weightage (NSRW) were introduced during the last decade to identify primary-school (elementary-school in United States) students, who have a higher risk of acquiring scoliosis. If both indicators were equal to or above threshold, the student fell into the category of high risk, to be followed through (monitored) till the end of growth period (19th birthday for females; 21st birthday for males). When one of the indicators was equal to or above threshold and the other below threshold, the incumbent belonged to medium-risk category, to be followed through till the student reaches 16th birthday. If both indicators were below threshold, the student was classified as low-risk case. Such a youngster should be followed through till the individual reaches 11th birthday. The authors propose an AI-based system to replace the human totally for examination, recording and scoring of different indicators to compute CSRW and NSRW. The benefits of such AI-based system for scoliosis-risk assignment are that it could be applied remotely and able to process patients in multiple centers, simultaneously, taking the burden off the humans involved in the examinations. In addition, patients (in particular, females) would feel more comfortable to be examined by a computer algorithm, as they do not have to undress in front of a physician for visual checks and forward-bending tests. Further, analysis of moiré fringes and dotted-raster patterns can only be done by computers and is not possible by human technicians. The challenge is to develop and test the proposed system on a valid sample drawn from a large population so that the AI-based results and the human-examination results match with a confidence level of 95% or more. Only then the AI-based system would be accepted by orthopedic surgeons, scoliosis patients, at-risk children and their parents. Power-Point-Show Slides

Keywords – Cumulative-Scoliosis-Risk Weightage (*CSRW*), *Differential-Spinal-Function Testing* (*DSFT*), *Modeling of the human spinal column, Normalized-Scoliosis-Risk Weightage* (*NSRW*), *Scoliosis-like conditions* Full Text

 Video-Recorded Presentation