

A shoveling-related pain intensity prediction expert system for workers' manual movement of material

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Abstrak

In this study, a fuzzy-based expert system called the Pain Intensity Prediction Expert System (PIPES) was developed to predict pain severity risk (PSR) in shoveling-related tasks. The primary objective was to develop a non-changing rating risk assessment ergonomics tool that both efficient and comparable with those obtained from human ergonomics experts in the field of application. PIPES used fuzzy set theory (FST) to make decisions about the level of pain associated with a selected worker base on the measured task variables, namely scooping rate, scooping time, shovel load, and throw distance as input and PSR as the result. Values obtained from variable measurements from a sand shoveling task were run with PIPES, and the results were compared with the workers' self-reported pain (WSRP) intensity using a numeric rating scale (NRS) tool. The result of validation showed that there was a strong positive relationship between WSRP NRS and PIPES NRS, with a correlation coefficient of 0.70. The independent sample t-test for mean difference showed that WSRP had a statistically significantly lower level of NRS (4.35 ± 2.1) compared to PIPES (4.75 ± 2.2), $t(38) = -0.591$, $p = 0.558$. With a significance level of 0.001 at 95% confidence, the groups' means were not significantly different. The study developed an expert system, PIPES, which can be used as a computerized representation of ergonomics experts, who are scarce. PIPES can be applied to construction industries, sand mine locations, and any workplace where materials are manually moved using a shovel.