

## LUMBAR SPINE PREVENTATIVE & REHABILITATION PROGRAM

**Theron King** B. Ed. (Sports Science)  
Hills St. Sports Medicine & Rehabilitation Centre

**Denny Shearwood** B.APP.SC. (Physiotherapy) M.A.P.A.  
Appointed Physiotherapist for the Australian Team to the Sydney 2000 Olympic Games  
Hills St. Sports Medicine & Rehabilitation Centre

### SUMMARY

A special report was released in April this year by the NSW Department of Mineral Resources concerning strain and sprain injury claims for surface coal operations. It stated that lower back injuries totalled 36% of all claims, the closest rival being neck & knee injuries at 10% according to JCB statistics.

This paper describes the proactive approach and results of an open cut coal mine in reducing the rate of lower back incidences. The process is via a lumbar spine strengthening and rehabilitative tool known as the Med-X Lumbar Extension Machine (Med-X Chair).

**Those that participate in the program are almost three times less likely to record a lower back first aid report.** Current participation rates are 27% of the mine population.

The program is managed and run by the Hills Street Sports Medicine & Rehabilitation Centre (Hills St.).

### INTRODUCTION

Lemington Coal Mine near Singleton in the Hunter Valley of New South Wales introduced a lumbar spine preventative and rehabilitative program in June 1996 with the vision of decreasing the amount of down time due to injury or pain to the lumbar spine. Historical records at Lemington Mine demonstrate that 70% of all Lost Time Injuries and up to 90% of time lost on workers compensation resulted from lower back injuries.

The program is an adopted and refined version currently being used by an associate mine in the United States. It was hoped that the success they had experienced could be transferred to Lemington.

“We believe this program is a highly innovative, but also a highly successful process which addresses the major safety ‘sleeper’ in the open cut mining industry – that of lower back pain.”

Peter Barton (Safety Manager for Lemington Mine) – 1996

**In 1996 the Med-X Program won first place in the NSW Mineral Councils’ Innovations for Occupational Health & Safety Awards.**

Over the years there have been a number of meaningful studies devoted to the relationship between decreased strength and increased pain levels. The following quote is from a study of the effect of workplace based strengthening on lower back injury rates:

**“The significant increase in strength associated with the exercise program correlated with the greatly reduced incidence of back claims.”**

**The Effect of Workplace Based Strengthening on Low Back Injury Rates: A Case Study in the Strip Mining Industry. (Mooney, Kron, Rummerfield & Holmes 1995) – Journal of Occupational Rehabilitation, Vol. 5, No. 3, 1995**

The theory behind the inversely proportional strength/pain relationship is that when muscles supporting the spine are rendered weak and wasted due to disuse (e.g. the case of pathology), there exists around the base of the lumbar spine a lack of core stability. This instability is commonly associated with increases in the level of pain mainly due to unwanted movement at the vertebral segments.

The analogy can be made between a tall thin building that has girders to stabilize the structure in an upright position - without these supports the building would sway around and eventually give way.

Workers Compensation Report (No. 290) refers to a study by Dr Julie Hides of the Queensland University physiotherapy department. It states:

**“...While all patients felt they could go back to duties up to ten weeks following their injury, ultrasound studies showed the muscles of the patients who exercised were back to their pre-injury state, while the other patients muscles were not as supportive. The implication is that the less muscle protection the greater the risk of further injury....One year later, back pain recurred in 80% of the non-exercisers, compared with 30% of the exercisers...exercise (can) also be used in a preventative sense.”**

The Med-X machines unique pelvis restraint system enables isolation of lumbar flexion and extension making it possible to accurately measure the lumbar spine range of motion (R.O.M.). R.O.M. can be limited by a number of different reasons. For instance short soft tissue, such as tight erector spinae muscles or intervertebral ligaments. In some cases if a person has a larger than average abdominal area, this will restrict forward flexion because of opposition of stomach to thigh. Full R.O.M. on the machine is measured in the form of degrees. (0 degrees extension, to 72 degrees flexion.)

The April 2000 Mineral Councils' Strain & Sprain Injury Claim report mentions also that;

**“An increase in stiffness to the joints and a loss in the bodies ability to dampen stress, particularly on the lower back results in a higher proportion of claims for older employees.”**

Whether it be at the lumbar spine joints or any other joints in the body, the same philosophy holds true, in that when there exists one or more stiff segments, there always exists associated painful segments. The reason why manual therapists in the form of physiotherapists and chiropractors are so effective in the short term relief of pain is due to techniques used for mobilization or manipulation of vertebral joints as to cause an increase in the R.O.M. and thereby decreasing associated pain.

The Med-X Chair has been described as the 'missing link' in the treatment of lower back pain. The exercises on the chair provide a reversal of muscle waste due to disuse by strengthening and increasing the flexibility of the participants' lumbar muscles.

Hills St. operated one of only two Med-X Chairs located in Australia at the time. They have been utilising the machine at their clinic now for 8 years.

## **PROCESS**

After receiving a clearance from his or her doctor each person participated in:

- 1) A fitness appraisal
- 2) Pre and post program pain scale questionnaire
- 3) Pre and post physiotherapy bio-mechanical assessment
- 4) A home exercise program based on the biomechanical findings
- 5) Initial static test on the Med-X Lumbar Extension Machine to determine strength, R.O.M. and initial starting resistance
- 6) 14 dynamic workouts at regular increases of resistance on the Med-X machine until volitional fatigue is reached
- 7) Post programme static test for comparisons in R.O.M. and strength
- 8) A regular maintenance program of one visit per month minimum.

The Med-X Chair is fundamentally a pin loaded weight machine linked to a computer that isolates the lumbar muscles and measures their strength and flexibility.

It is important to recognise that the success of the lumbar exercise program is not just in measuring strength and flexibility components. Other parameters include a subjective pain scale survey, assessment of fitness levels and a physiotherapy and biomechanical screening that looks at variables such as posture type, total body flexibility, history of lumbar spine problems, and the appropriateness of each applicant to be on the program. The Hills St. team because of their clinical experience in the area of back care felt that the use of the Med-X machine alone to deliver a total and comprehensive program was not realistic. For this reason a biomechanical screening was added to the program. This screening not only identified potentially harmful causes of back pain, but also aided in preventing them from retarding the overall success of the back care program.

Back pain is caused by numerous reasons. One solution will not fix every problem. If a program is to be successful then the program must focus on the contributing factors that cause back pain. Such things as bad posture, weak back and abdominal muscles, poor fitness and weight problems. This is why Lemington Mine introduced a healthy lifestyles program in conjunction with the back exercise program. It covers the aspects of exercise, nutrition and weight loss. An encouragement of physical activity would be seen as being extremely beneficial in relation to lower back pain as well as in general well being at home and at work.

**RESULTS:**

**(1) PERCENTAGE INCREASE IN STRENGTH**

GRAPH INTERPRETATION (figure 1)

A pre and post program strength test is conducted so that the correct weights can be determined and strength gains can be measured

One participant recorded an amazing 140% increase in strength, while eight participants had increases of over 80%. Half the participants recorded gains of over 45%, which is almost half their initial strength again.

**The total average strength increase is 40.88%.**

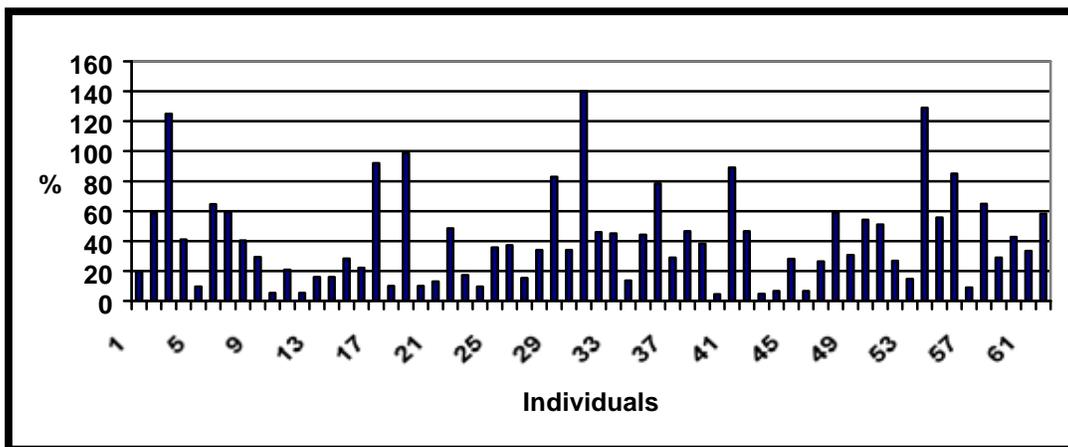


Figure 1

**(2) RANGE OF MOTION**

GRAPH INTERPRETATION (Figure 2)

Looking at the initial R.O.M. bar (see below) it is evident that 42% of people tested couldn't obtain 72 degrees which constitutes a full R.O.M. Following the program, when re-tested this lack of flexibility

decreased to 15% of the study. It would be fair to say that about half of the 15% would never achieve 72 degrees until their abdominal girths were significantly decreased.

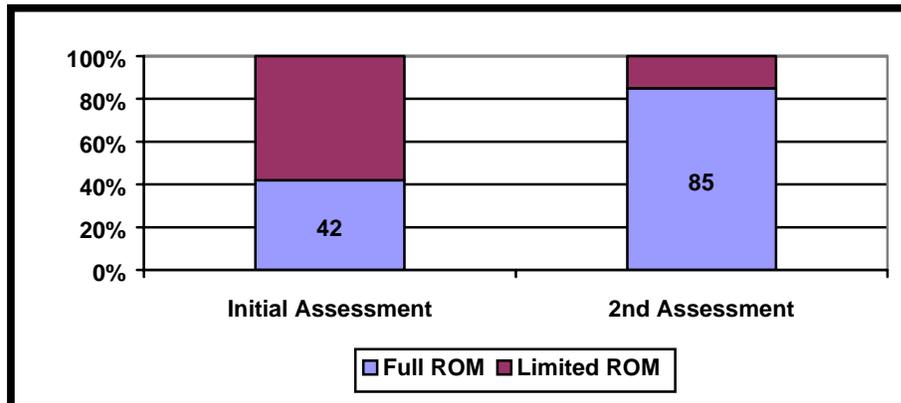


Figure 2

### (3) MULTIDIMENSIONAL PAIN INVENTORY SURVEY

As another parameter of measurement, a multidimensional pain inventory comparison was implemented prior to and following the Med-X back program. The idea of such a questionnaire is to rate out of ten the persons description of pain and how it affects their lives. All the questions were broken up into three categories: -

1. Severity
2. Interference
3. Frequency

Severity is being the individual perception of the intensity of the pain. Interference is how much pain interferes with their daily lives, and frequency is asking how many episodes of back pain have they experienced over a period of time.

#### GRAPH INTERPRETATION (Figure 3)

Pain severity, interference and frequency are illustrated on the inventory survey as three separate bar graphs and represent a percentage decrease in each of the categories. In total there was a mean decrease in pain severity of 50%. Interference experienced a drop of 39% and there was a 42% decrease in the frequency of back pain.

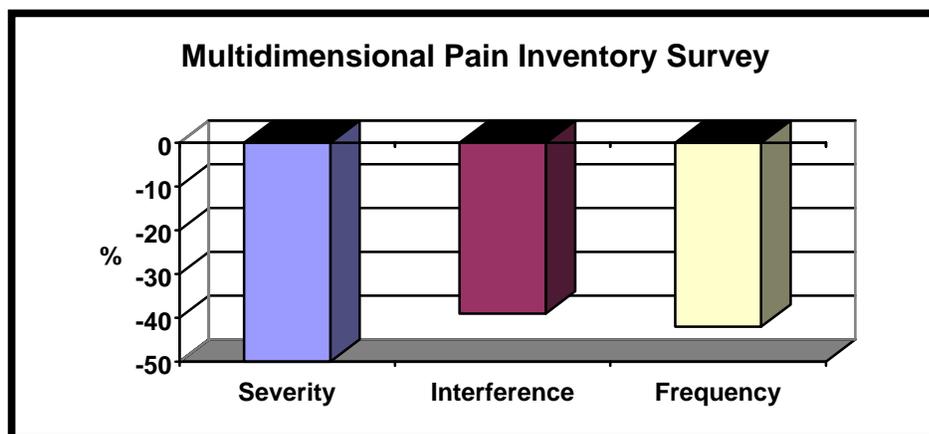


Figure 3

## CONCLUSIONS

### (1) UNION ISSUES

The union was initially skeptical about what the Company was implementing, wondering if there was a hidden agenda involved. It had to be stated in no uncertain terms that all information gained on the individual was strictly confidential and would remain the property of the individual and that of Hills St.. All feedback to the company is to be on group basis only.

The other major concern was whether or not the individuals could participate during work hours. A compromise was reached between the Union and the Company in that it was to be encouraged for workers to be largely involved in the program outside of work hours and during meal breaks. However, in certain situations where production was not interfered with (e.g.: wet days for Operators or low maintenance days for Electricians & Fitters) then the program would be available during work hours.

### (2) LOWER BACK FIRST AID INCIDENCES FOR 1999

**“In 1999 there were 42 first aid cases with regard to lower backs, only five of which were Med-X participants.”**

**John Janetzki – (Safety Manager Lemington Mine – 16<sup>th</sup> March 2000**

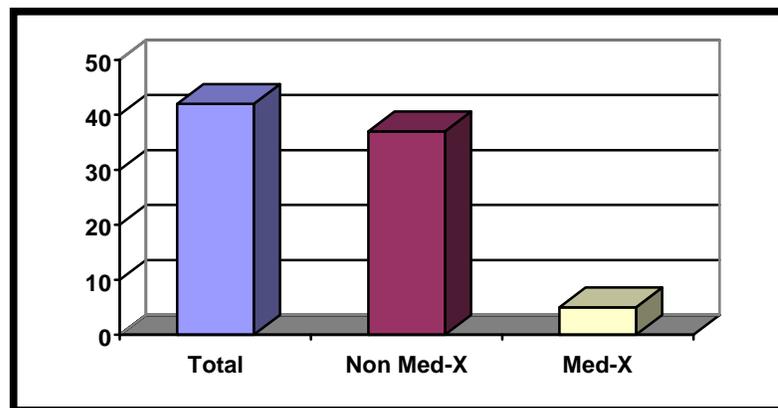


Figure 4

From the above graph (Figure 4) it can be recognised that of those 42 cases, 5 reports were made from the 86 people on the Med-X program (a ratio of 1:17), versus 37 reports made from the 234 people not on the Med-X program (a ratio of 1:6). **Therefore it could be argued that those employees NOT on the Med-X program have a 2.8 times greater chance of recording a Lower Back First Aid Report than those on the Med-X program.**

### (3) LOWER BACK ACCIDENT CLAIMS AT LEMINGTON V'S INDUSTRY – OPEN CUT

According to the Joint Coal Boards Statistics Centre in 1996 Lemingtons' Incident Rate (see Figure 5 below) was 6.6 lower back accident claims per 100 employees as compared to the Industry Rate of 3.9 lower back accident claims for the Open Cut Mining Industry. By the end of 1999 Lemington had reduced its rate to 4.1. Although we are still above the Industry Rate there has been a 38% swing in the right direction.

YEAR	LEMINGTON RATE	INDUSTRY RATE
1996	6.6	3.9
1999	4.1	3.4
% Drop	38%	13%

Figure 5

The question is, are those participants on the Program a true representation of the total Lemington workforce? The Program is not a true representation of the total workforce since it is purely a voluntary program as compared to a random selection. However, it should be noted that ***the majority, 71%, of the people attracted to the program to date has a history of lower back pain.*** In fact, those without back pain have been the hardest to get on the program, and once on, have been the hardest to keep on the program. This could largely be due to the fact that the decreased pain and increased mobility incentives aren't as prevalent in these people.

Our best marketing within the mine has been and always will be word of mouth. Twelve months ago the Program participant represented 15% of the total mine population at Lemington. ***Today the Program participant represents 27% of the total mine population and is continuing to rise.*** It is hoped that these numbers will continue to increase and that the vision from 1996 of decreased down time due to injury or pain to the lumbar spine is achieved even further then what we are doing today.

#### REFERENCES

Mineral Resources New South Wales. (April 2000). Strain and Sprain Injury Claims in Surface Coal Operations. MDG 3004 SR2000/2

Mooney, Kron, Rummerfield & Holmes. (1995). The Effect of Workplace Based Strengthening on Low Back Injury Rates: A Case Study in the Strip Mining Industry. Journal of Occupational Rehabilitation, Vol. 5, No. 3, 1995

Workers Compensation Report (Issue No. 290, November 19, 1996)