

## Unit Lesson

In the last unit, we reviewed how human factors can influence occupational injuries and illnesses. When

safety professionals think about human factors related to injuries and illnesses, it is very common to think

about human errors. In other words, what did the employee do wrong that contributed to or caused the injury

or illness? In many cases, it is not human error that causes an injury or illness, but the interaction of the

employee with the physical environment of the workplace.

The interaction of workers and machines has always been a problem. Prior to the Industrial Revolution,

America was primarily an agrarian society. A large percentage of agricultural output was from small family

farms. Work was performed with primitive tools and required great physical efforts. Although the term

musculoskeletal disorder (MSD) was not yet in use, we can imagine that many farmers suffered what today

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would be called an MSD. We do not know the extent of MSDs for this group of workers because statistics

were not kept at that time.

With the start of the Industrial Revolution in the United States, an entirely new set of physical stressors was

introduced. Work started moving from the family farms to manufacturing facilities in towns and cities. Starting

in the early 1700s, there were many inventions that both improved the production of consumer goods and

increased the physical stresses to the employees working in businesses to produce those goods.

Some of the early inventions that had a profound impact on production in America included the steam engine

(1712), the flying shuttle (1733), the spinning Jenny (1764), the circular saw (1780), the threshing machine

(1784), the power loom (1785), the cotton gin (1794), the metal lathe (1797), the Fourdrinier machine (used to

make paper; 1799), the typewriter (1829), and the sewing machine (1846) (Robin L, 2010).

While these

inventions greatly increased the production of goods in America, they also increased the physical stresses on

workers and the consequent injuries and illnesses.

The field of ergonomics in America arose from this interaction of workers and machines.

Understand that the

concept of ergonomics is not a new concept. In fact, the term ergonomics was first used in 1857 in a

philosophical narrative by a professor in Poland (Pandve, 2017). The term was not adopted by the safety field

until the middle of the 20th century.

Today, we primarily view ergonomics and human factors engineering as a science dedicated to preventing

MSDs. This was not always the case. Initially, the study of ergonomics and human factors was focused on

improving production. This focus increased greatly during WWII as the United States needed to produce

materials much more quickly and efficiently. After WWII, the emphasis continued to be primarily focused on

production. In fact, Henry Ford II delivered a speech at the annual meeting of the society of automotive

engineers about the challenge of human factors and engineering to meet that challenge. From the topic of the

speech, we might expect an emphasis on worker safety. However, if you read the speech, Mr. Ford does not

mention worker safety once (Ford, 1946). Instead, his speech focuses on how addressing the interaction of

workers and machines can help increase production and reduce the costs of automobiles, allowing more

people to purchase automobiles and increasing profits for companies. The only mention of lost work days had

nothing to do with injuries and illnesses, but dealt with lost days related to labor union strikes and how the use

of human engineering might reduce the number of strikes. It is amazing to see one of the leading industrialists

in America at that time discuss ergonomics and not once mention the relationship to worker health and safety.

Sometime after WWII, the focus of ergonomics and human factors engineering began to shift from increasing

production to worker safety. The costs associated with MSDs continued to increase. A report from the Bureau

of Labor Statistics (BLS) (n.d.) reported that 582,340 lost work days could be attributed to MSDs in 1999. This

represented 34.2% of all lost work days in the United States in 1999 (BLS, n.d.). A review of the BLS data

shows that the percentage of all lost work days that can be attributed to MSDs has increased steadily from

33.6% in 1992 to 34.2% in 1999. The direct costs were estimated to be \$20 billion, with indirect costs

estimated to be another \$80 billion (BLS, n.d.).

The Occupational Safety and Health Administration (OSHA) first became directly involved with ergonomics

issues in 1983. The OSHA Training Institute published its first training course on ergonomics that year. The

training program was updated to a video presentation in 1998 (OSHA, 1998). In 1986, OSHA started a

national emphasis program to reduce back injuries. The first OSHA citation for a musculoskeletal disorder

was issued in 1987 under the General Duty clause of the OSH Act. OSHA released a voluntary ergonomic

guideline for the red meat industry in 1990, which was updated in 1992 (OSHA, 1993).

In 1991, the American Federation of Labor and Congress of Industrial Organizations (AFL/CIO) and 30 other

unions requested that OSHA issue an emergency temporary standard for ergonomics because of the

increasing numbers of MSDs (AFL/CIO, 2004). OSHA issued an advanced notice of proposed rulemaking in

June 1992. As you can see from the textbook, the final passage of the ergonomics standard was very

political, and the standard was rescinded using the Congressional Review Act for the first time in history. The

rescission also prohibited OSHA from issuing any new ergonomics standard (Goetsch, 2019).

The prohibition from Congress required OSHA to take a new approach to addressing ergonomic issues in the

United States. OSHA's current approach is to issue guidelines for industries with high risks for MSDs. OSHA

currently has multiple guidelines for specific industries, including poultry processing facilities and nursing

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homes (OSHA, n.d.). Safety professionals in these industries need to become familiar with the OSHA

guidelines for their industry.

One reason human factors engineering is difficult is because of the complexity of workers. Most machines

and tools are designed for the "average" worker.

This means that a percentage of your workforce will

not fit the definition used to produce the tool or

machine they will be operating or using. Most safety

professionals understand an important variable in reducing MSDs is for workers to perform operations in a “neutral position.” Any task where a part of the worker’s body is placed in an unnatural position increases the risk of an MSD. Many hand tools are now designed to attempt to place the hand into a neutral position while performing certain tasks. A good example would be newer powered screwdrivers designed so the worker does not have to twist his or her hand to an uncomfortable position. The problem is that not all hands fit the new tool the same, and it is typically not cost-effective to fit every worker individually. Because ergonomics issues are typically very complex, ergonomics has developed into a specialty field with ergonomic degrees being offered at some institutes of higher learning and some national certifications being offered by organizations. Safety professionals must decide how much work they want to perform on ergonomic issues before calling in ergonomic specialists. Sometimes, the decision comes down to available funding from the employer, which may require you to perform investigations and recommend fixes that you are not comfortable with.

In some cases, you may not realize you have an ergonomics problem at your worksite. Performing a workplace analysis as described in the textbook can assist you in determining if there is a problem. Incidence rates are commonly used to detect problems. Incidence rates represent the number of new cases of an injury or illness over a specified time period. You can use incident rates to track specific injuries and illnesses,

including MSDs. An ongoing increase in the incidence rates of MSDs would indicate a problem might be

present. You can also compare your incidence rates for MSDs to the incidence rates for your industry as a

whole.

When you determine that a problem is present, you must perform an investigation to help determine causes

that can help identify possible solutions. Most ergonomic investigations are performed using a task analysis.

The textbook contains some examples of how to perform a task analysis. OSHA also has some forms that

can be used to perform a task analysis.

In some cases, injuries and illnesses are either caused or exacerbated by stress in the workplace.

Stress

would be another example of a human factor that can lead to accidents. Unlike the human factors we

discussed above, stress can be much more difficult to identify, measure, and control. Unlike measuring the

physical stress placed on a worker's hand, measuring psychological stress is very subjective. Many times, it is

difficult to get workers to participate in activities that help identify stress or in programs designed to reduce

stress.

Some companies have started a program where all employees are lead through a series of exercises

designed to reduce stress prior to the start of the work shift and sometimes at the lunch break.

The time spent

in the exercise costs the employer some in direct costs but is thought to reduce total costs with increased

productivity and safety over the long haul.

Sitting vs. Standing

Stationary vs. Moveable

Large vs. Small Demand for Strength

Good vs. Bad Vertical Work Area

Nonrepetitive vs. Repetitive Motion

Low vs. High Surface Contact

Factors associated with physical stress

(Goetsch, 2019, pp. 208-209)

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%20The%20AFL%20CIO%20and%2030%20affiliated%20unions,and%20issuing%20a%20standard%20using%20normal

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<https://www.brighthubeducation.com/history-homework-help/91805-important-inventions-of-the-industrial-revolution/>

### Suggested Reading

In order to access the following resources, click the links below.

In this unit, we mentioned that some companies have implemented stretching programs prior to the start of

work in an effort to reduce MSDs. The following article evaluated some of the stretching program to see how

effective they are at reducing MSDs.

Choi, S. D., Rajendran, S., & Ahn, K. (2017, May). Stretch & flex programs: Effects on the reduction of

musculoskeletal disorders & injuries. *Professional Safety*, 62(5), 38–43. [https://search-proquest.com.libraryresources.columbiasouthern.edu/docview/1900042510?accountid=33337](https://search-proquest.com/libraryresources.columbiasouthern.edu/docview/1900042510?accountid=33337)

Human factors and human factors engineering have been issues for centuries. However, they have not



always been linked to worker safety. The following link is to a speech presented by Henry Ford II shortly after

WWII. Read the speech and see where the emphasis for human factors engineering was placed at that time