DEFINING ERGONOMICS IN RELATION TO WORK AND PRODUCTIVITY

ARMSCOR
Armaments Corporation of South Africa SOC Ltd

Lesedi Milanzi

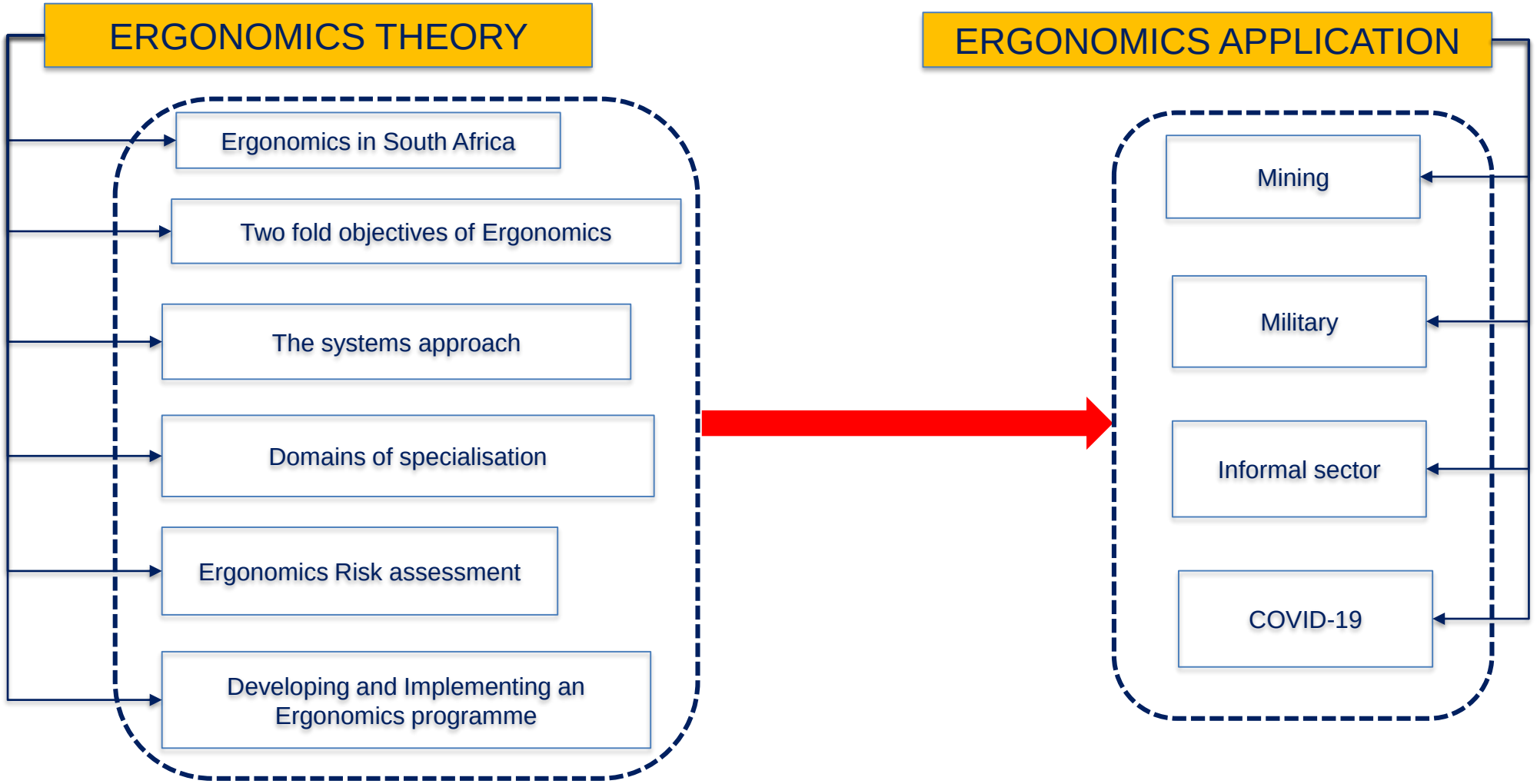
Ergonomics consultant ((Ergonomics Technologies (ARMSCOR)
(Certified Ergonomics Associate (CEA 1901- Ergonomics Society of South Africa)

NIOH WEBINAR: Working from home during COVID-19 & beyond: An Ergonomics perspective

GATEWAY TO DEFENCE SOLUTIONS

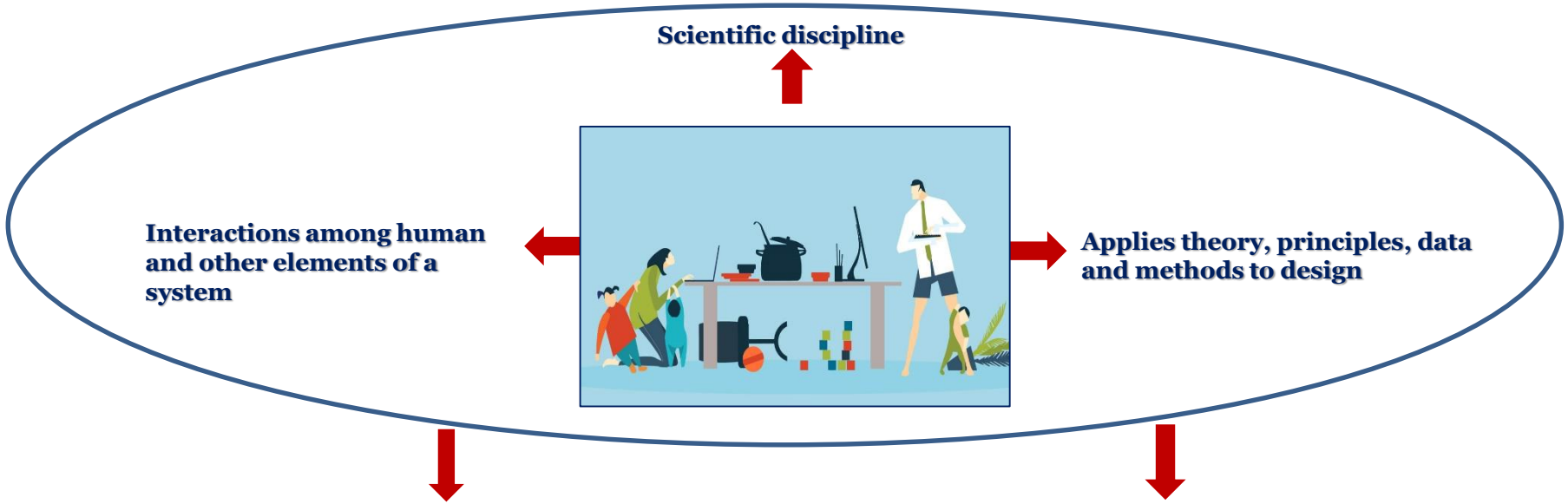
15 October 2020

PRESENTATION OUTLINE



WHAT IS ERGONOMICS

"**SCIENTIFIC DISCIPLINE** concerned with the **UNDERSTANDING OF INTERACTIONS AMONG HUMANS AND OTHER ELEMENTS OF A SYSTEM**, and the profession that applies theory, principles, data and methods to design in order to **OPTIMIZE HUMAN WELL-BEING AND OVERALL SYSTEM PERFORMANCE"** International Ergonomics Association (IEA) 2000



OPTIMISE HUMAN WELL-BEING

- Enhancing safety
- Reducing fatigue and stress
- Increasing comfort
- Having greater user acceptance
- Increased job satisfaction
- Improved quality of life

OVERALL SYSTEM PERFORMANCE"

- To enhance the **effectiveness** and **efficiency** with which the task is carried out

ERGONOMICS IN SOUTH AFRICA

- Not a new concept, referenced in Occupational Health and Safety Act (Act 85 of 1993):

- OHSA and the regulations
  - General administrative regulations
  - General safety regulations
  - Major hazard installation
  - Hazardous Biological agents regulation
  - Explosives regulation
  - Construction regulation
  - Environmental regulation for workplaces
  - Facilities regulations
  - Noise induced hearing loss regulations
  - Hazardous chemical substances
  - **Ergonomics regulations**

- Gazetted December 2019 (Department of Employment and Labour)

SUB-REGULATIONS IN THE ERGONOMICS REGULATION

ARMSCOR
Armaments Corporation of South Africa SOC Ltd

- Section 1: Definitions
- Section 2 : scope of application
- Section 3: Information, instruction and training
- Section 4 Duties of persons who may be at risk of exposure to ergonomic risks → Obey any lawful instruction given by the employer or self employed person, or an authorised person
- Section 5 Duties of designers, manufacturers, importers and suppliers → Reasonably practicable, Optimise human well being and overall system performance

Section 6 Ergonomics risk assessment

- Process
  - Before commencement of work
  - After consultation with health and safety committee
- Risk assessment content
  - Hazard identification
  - Homogenous exposure groups
  - Health effects
  - Analysis and evaluation of risk
- Risk assessment review
  - No longer valid
  - Ineffective control measures
  - Technological or scientifically advances of control
  - Change in work methods, machines, type of work
  - Incidences and accidents

SUB-REGULATIONS IN THE ERGONOMICS REGULATION

ARMSCOR
Armaments Corporation of South Africa SOC Ltd

Section 7
Risk Control → Reasonably practicable

Section 8
Maintenance of controls → Reasonably practicable

Section 9
Risk Control

Medical Surveillance

- Risk Based
- Risk assessment

Occupational Health Practitioner

Initial Medical surveillance- 30 days of commencement of work

Periodic Medical surveillance- as prescribed the Occupational medical practitioners

Exit- informed by the ergonomic risk assessment

Section 10
Records

Records keeping

1. 3- Information, instruction and training
2. 6- Risk Assessment
3. 7- Maintenance of controls
4. 8-Medical surveillance
5. 9- Maintenance of controls

Records	**Minimum storage period**
6- Risk Assessment 8-Medical surveillance	40 years
7- Maintenance of controls 9- Maintenance of controls	3 years
3- Information, instruction and training	As long as the employee is in the workplace

Make available records

1. Health and safety reps, health and safety committee

3- Information, instruction and training

6- Risk Assessment

7- Maintenance of controls

9- Maintenance of controls

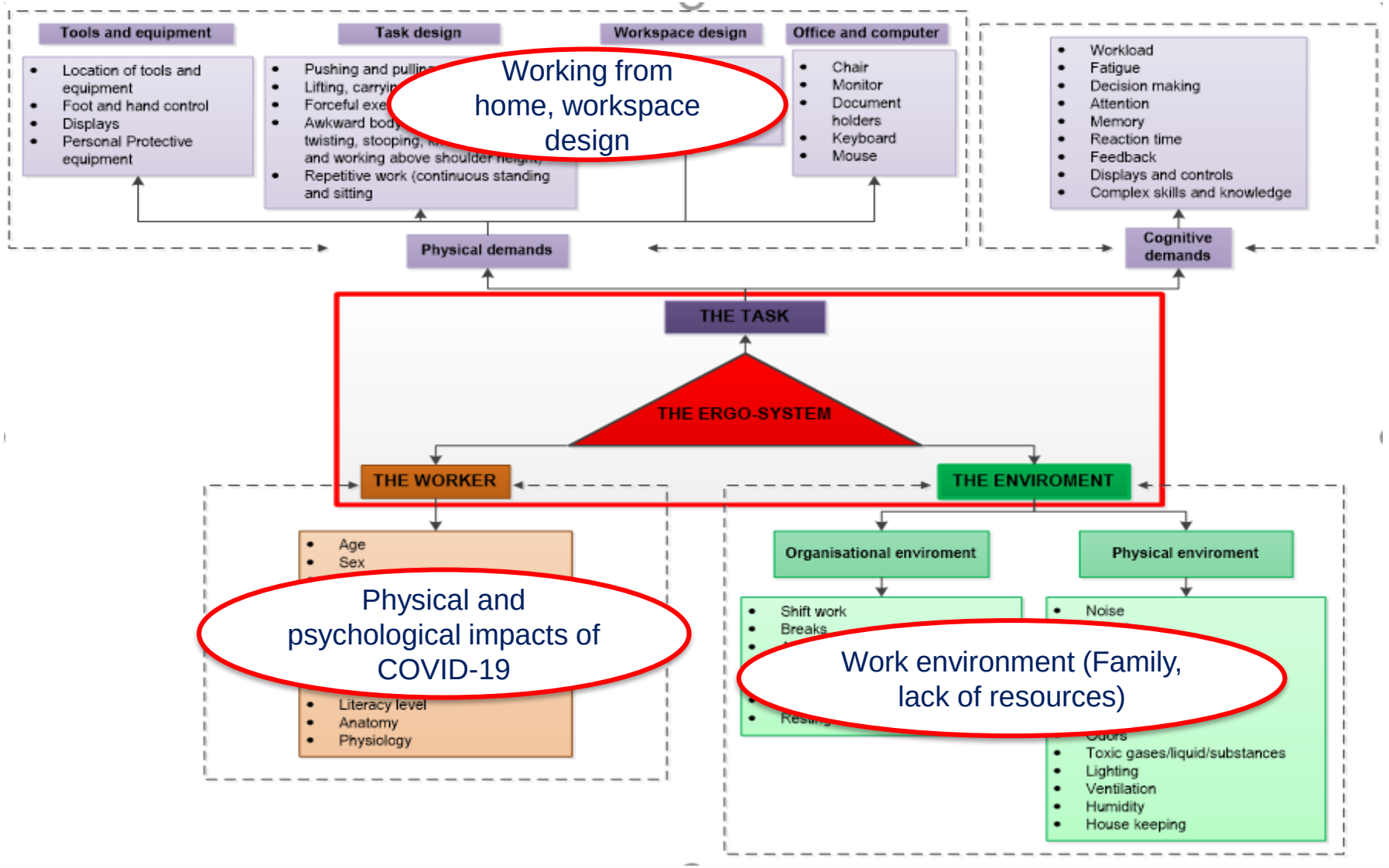
2. Any person (Written consent)

8- Medical surveillance

Business closure

1. Records sent to the Chief Director: Provincial operation
2. Content of records specified

ERGONOMICS AND THE SYSTEMS APPROACH



ERGONOMICS DOMAINS OF SPECIALISATION

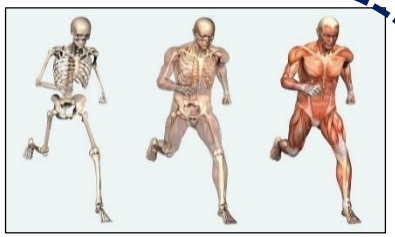
ARMSCOR
Armaments Corporation of South Africa SOC Ltd

1. **PHYSICAL ERGONOMICS**

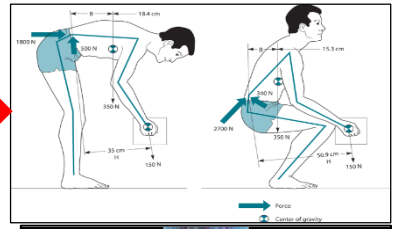
2. **COGNITIVE ERGONOMICS**

3. **ORGANISATIONAL ERGONOMICS**

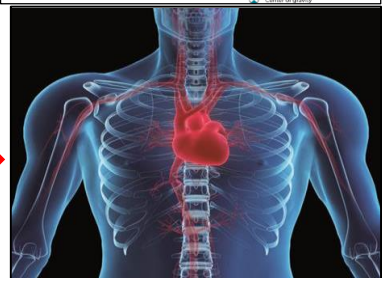
Human anatomy



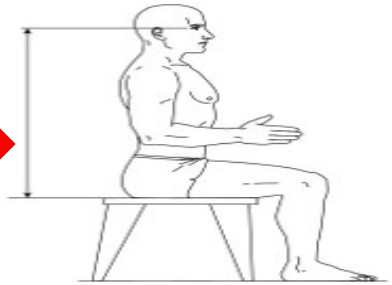
Biomechanics



Physiology



Anthropometry



PHYSIOLOGY

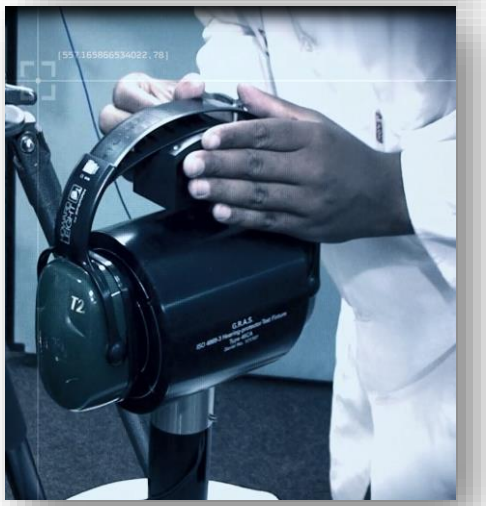
- Human physiology is the science of the mechanical, physical, and biochemical function of humans

- Creates a framework for understanding how the human body adapts to stresses, physical activity,

- The Physiological Strain Index (PSI); useful tool to determine the impact of environmental temperatures and physical work on individual, based on core body temperature and heart rate, two physiological parameters that adequately depict the combined strain reflected by the cardiovascular and thermoregulatory systems

    - CorTempTM Physiological Monitoring Systems

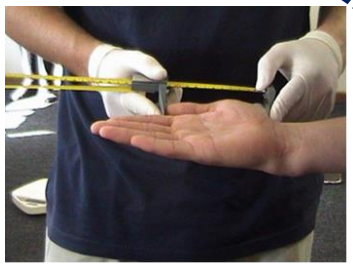
- Hydration and water systems interfaces, Energy expenditure, Sensory perception (Sound localisation, Visual contrast sensitivity, Vibrotactile displays), Aerobic capacity ,Protection strategies for environmental hazards (Frequency and vibration exposure, Impulse noise and blasts), Exertional heat stroke, Toxicology, Overtraining, different weapons, Physiological strain index



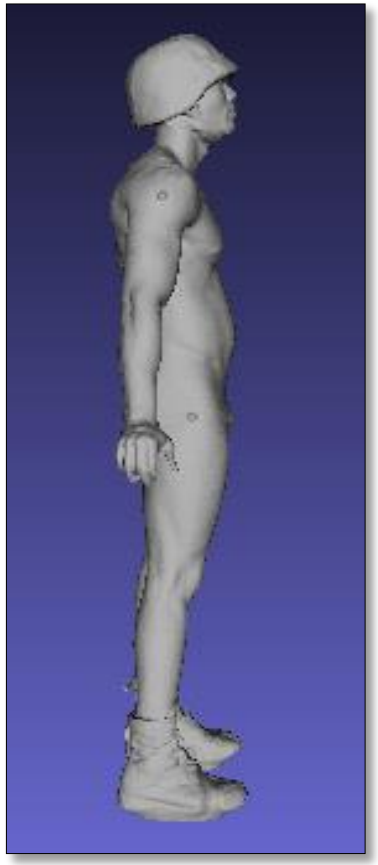
ANTHROPOMETRY

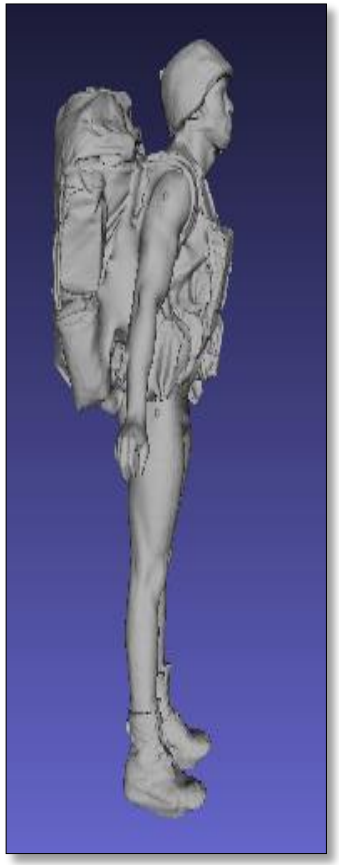
The study of human body measurements and proportions using standardised techniques , absolute and relative variability in size and shape of the human body" for Clothing design, Armour design and development, Human modelling, Characterising body shape, Encumberment, Updating databases, design of clothes, face masks

- One Dimensional (1D)
  - Traditional manual measurements

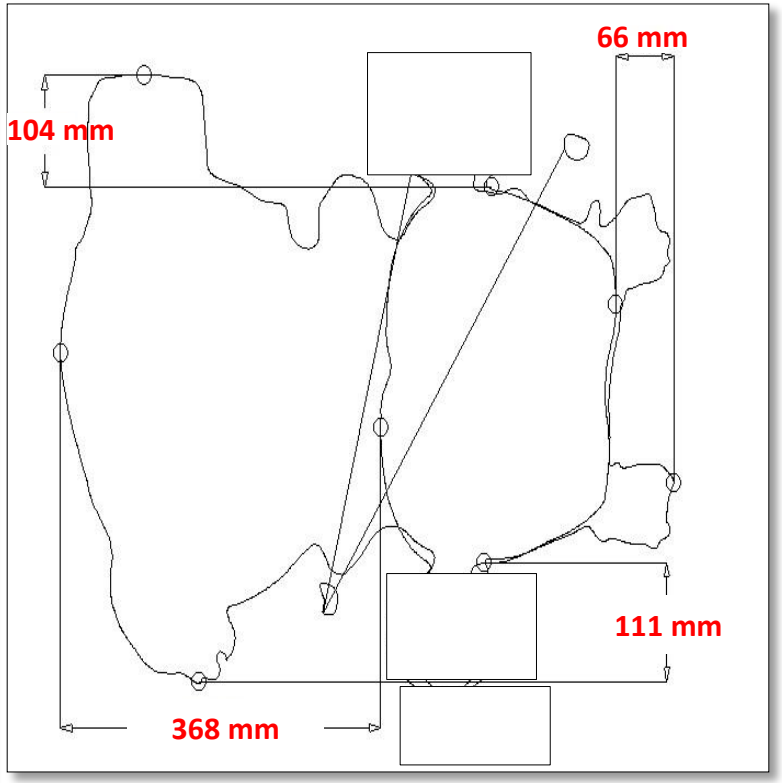


- Three Dimensional (3D)
  - Foot scanner
  - Head scanner
  - Whole body scanner





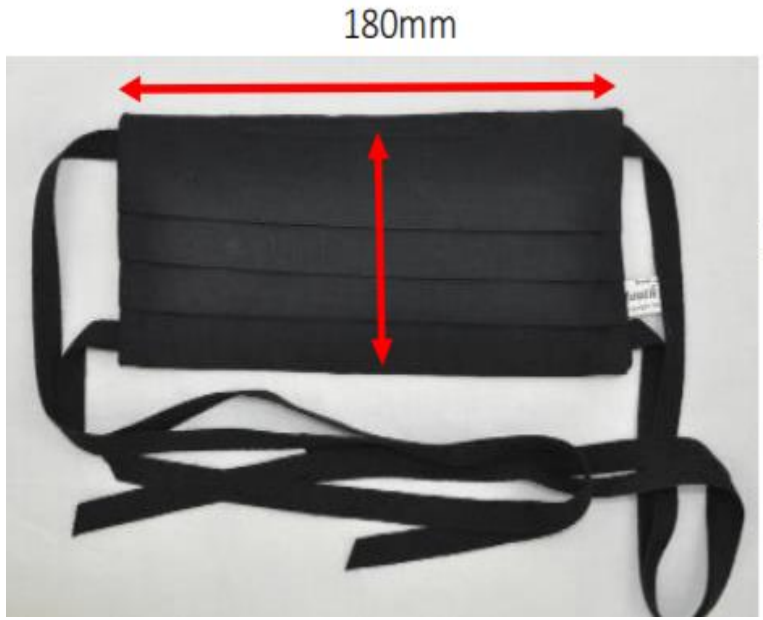
Traditional vs encumbered



Cross-section Deltas

ANTHROPOMETRY

RECOMMENDED GUIDELINES – UPDATED FABRIC FACE MASKS- DEPARTMENT OF TRADE INDUSTRY AND COMPETITION



Anthropometric data of different countries (SA ; USA)

MANUAL MATERIALS HANDLING AND ERGONOMICS RISK FACTORS

ARMSCOR
Armaments Corporation of South Africa SOC Ltd

- Musculoskeletal disorders (MSD's) are conditions which **affects muscles, tendons, joints, nerves, vessels and supporting structures.**

- **Work related and none work related exposures** are linked to MSDs e.g physical, organizational and social aspect of work and physical and social aspect of life outside work

- Few epidemiological studies have investigated the role of ergonomics factors in the occurrence of MSD'. In industrialized countries occupational musculoskeletal disorders cited as a major cause of **inefficiency, absenteeism and fatigue.**

- Lower back pain is the most prevalent

  - **CAUSES OF WMSDS:** Heavy, Frequent, or Awkward Lifting, Pushing, Pulling or Carrying Loads, Working in Awkward Postures, Hand Intensive Work
  - **RISK OF INJURY DEPENDS UPON:** Duration of exposure, Frequency of exposure, Intensity of, exposure, Combinations of risk factors
  - **RISK FACTORS SEVERITY:** Bending, Twisting, Reaching, Awkward body posture
  - **WMSDS ARE ALSO KNOWN AS:** Cumulative Trauma Disorders (CTDs), Repetitive Strain Injuries (RSIs), Overuse injuries

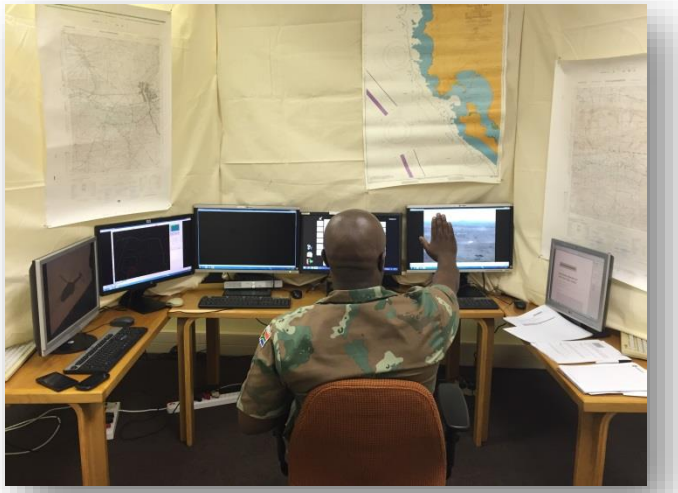
MUSCULOSKELETAL DISORDERS AND COVID-19

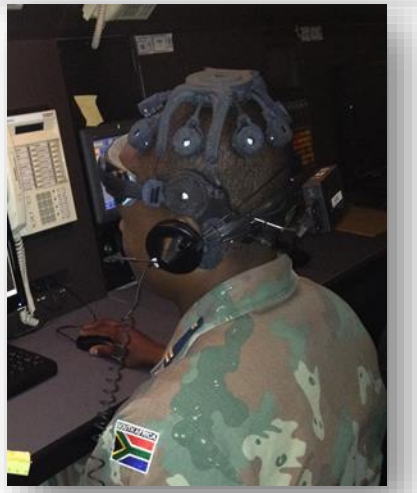
- Impact of COVID-19 Quarantine on Low Back Pain Intensity, Prevalence, and Associated Risk Factors among Adult Citizens
- Self-administered structured questionnaire composed of 20 questions regarding demographic characteristics, work and academic-related aspects, physical activity (PA), daily habits and tasks, and pain-related aspects was used.
- The LBP point prevalence before the quarantine was 38.8%, and 43.8% after the quarantine
- The COVID-19 quarantine resulted in a significant increase in LBP intensity, point prevalence, and most associated risk factors.

COGNITIVE ERGONOMICS

ARMSCOR
Armaments Corporation of South Africa SOC Ltd

- Access mental processes while performing work
  - Human Computer Interaction , human machine interaction
  - Mental workload and decision making
  - Simulators in training
  - Impact of Technology Information Systems on worker Performance
  - Ergonomics Considerations for Simulators
  - Focus on adaptive automation





- COVID-19 Virtual platforms have become a norm, contact training vs virtual training?

ORGANISATIONAL ERGONOMICS

ARMSCOR
Armaments Corporation of South Africa SOC Ltd

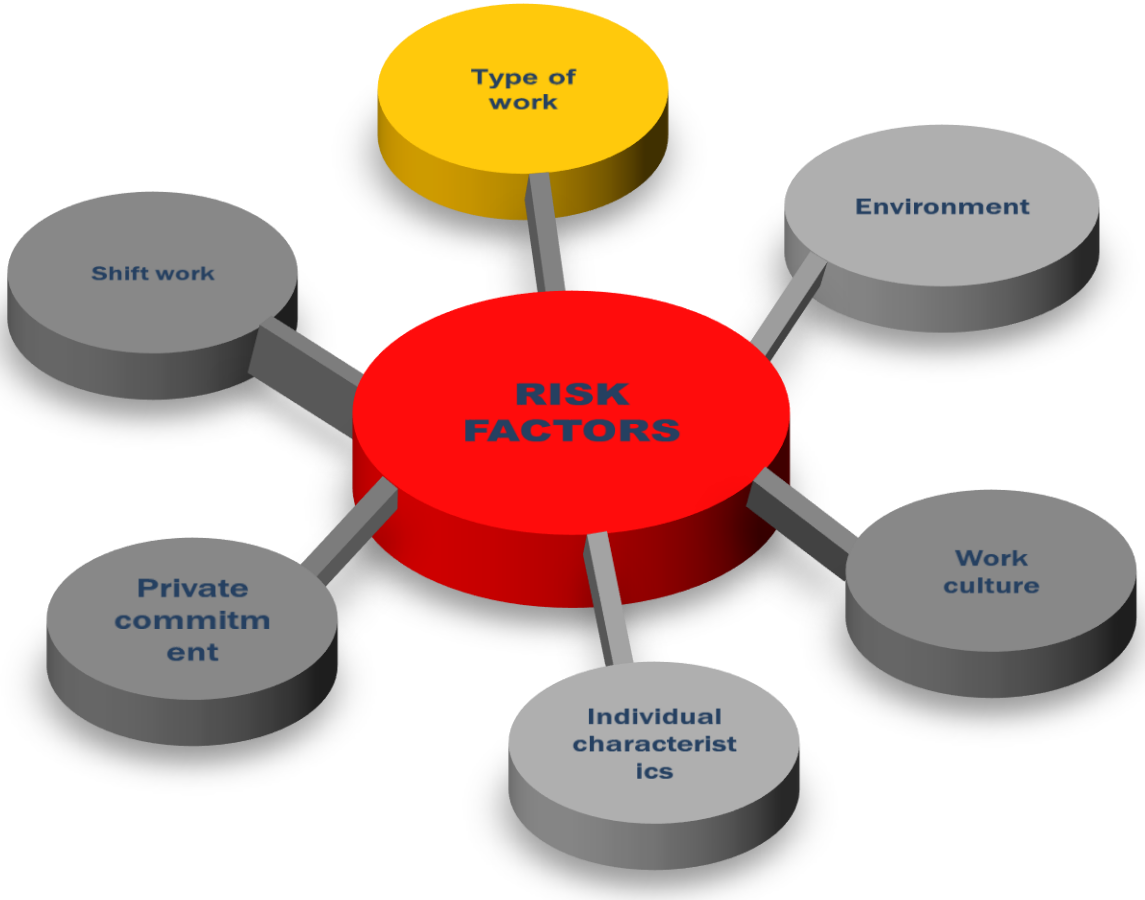
Organisational ergonomics is concerned with the optimization of socio-technical systems, including their organisational structures, policies and processes

- Shift work
- Fatigue
- Culture transformation framework for the Mine health and safety

- Develop a health and safety culture transformation framework

  - Identify the key elements of a high performing health and safety culture, i.e values, associated behaviours;
  - Define factors that promote or inhibit achievement in health and safety,
  - Identify and assess models that provide a suitable framework for the improvement of health and safety culture,
  - Develop an appropriate framework for the South African mining sector,
  - Develop indicators and monitoring tools to measure progress on an ongoing basis
  - Assess the level of health and safety culture within the mining industry with a comparison across various commodity sectors.

E.G FATIGUE IN THE HEALTH SECTOR DUE TO COVID-19

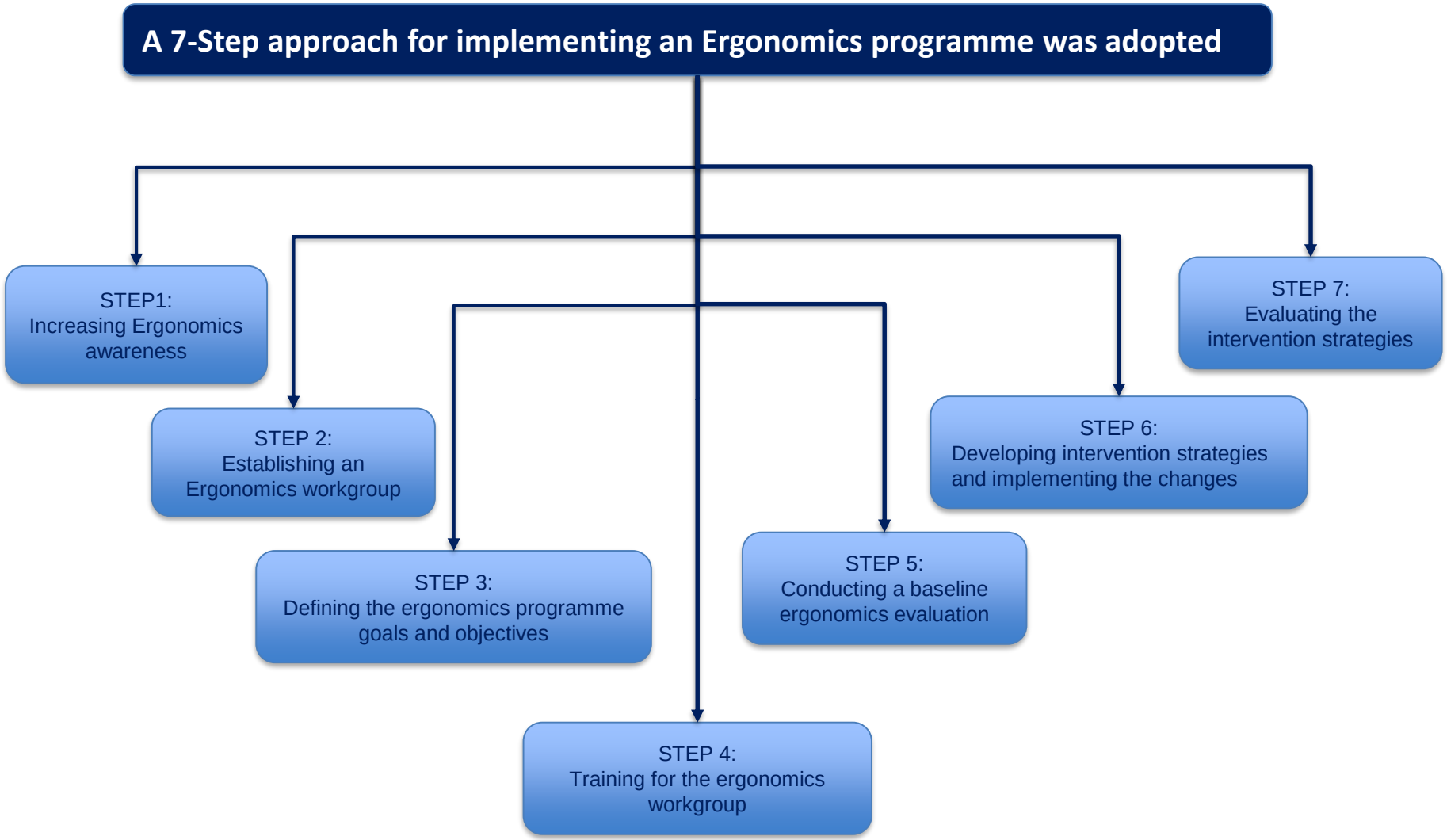


- Rising levels of fatigue, due to the relentless heavy workloads with ever-increasing cognitive, psychosocial and physical work demands.

- Workloads exacerbated by increasing patient acuity, higher patient volumes and the growing number of COVID-19 cases.

ERGONOMICS PROGRAMME

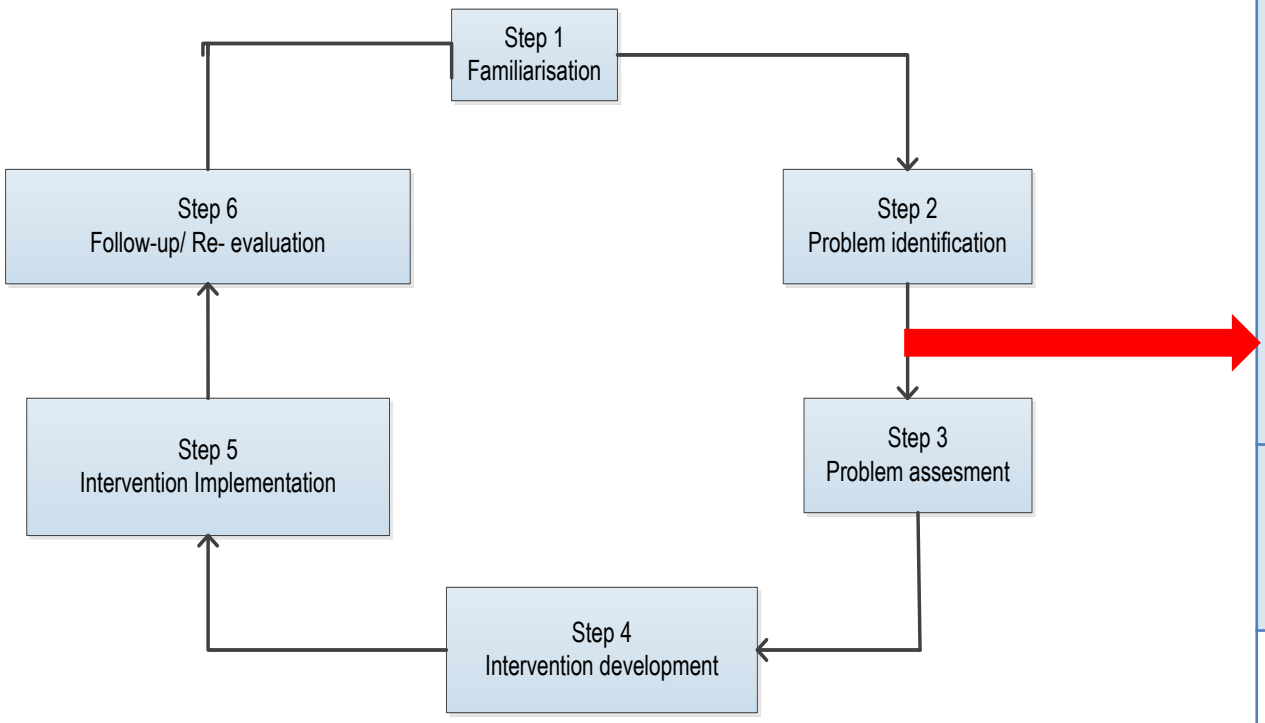
ARMSCOR
Armaments Corporation of South Africa SOC Ltd



THE RISK ASSESSMENT PROCESS

ARMSCOR
Armaments Corporation of South Africa SOC Ltd

CONDUCTING A BASELINE ERGONOMICS EVALUATION : METHOD OF RISK EVALUATION



	ERGONOMICS SCREENING TOOLS		CHARACTERISTICS
Physical demands	Manual Materials Handling tasks	Liberty Mutual Tables for lifting, carrying, pushing and pulling	These tables are used for setting weight limits for lifting, carrying, pulling and pushing tasks. The tables use frequency, location of load in relation to the body while performing the task and the distance travelled while handling the load. (Snook and Cirrielo, 1991).
		NIOSH lifting equation	The NIOSH equation was developed by the National Institute for Occupational Safety and Health. This equation is used for setting weight limits for asymmetric lifting tasks (Dempsey, 2002).
	Exertion and discomfort	Body discomfort map and scale	The Body discomfort scale is a basic tool that is used to identify any discomfort associated with the task been performed (Wilson and Corlett, 1992).
		Standard Nordic Musculoskeletal Questionnaire	Identifies more with recent than older and less serious musculoskeletal disorder REF
		Rating of perceived exertion	The modified Borg rating of perceived exertion is a way of measuring physical activity intensity level (Scott, 2009).
		Cornell Musculoskeletal Questionnaire	Evaluates task to identify possibility of musculoskeletal disorder prevalence and applicable to sedentary and standing work REF
		Cornell Musculoskeletal Hand Questionnaire	Evaluates tasks to identify possibility of musculoskeletal disorders prevalence and applicable to hand symptoms
	Working posture and repetitive Tasks	Rapid Entire Body Assessment (REBA)	Rapid Entire Body Assessment (REBA) is an ergonomic assessment tool which utilizes a systematic process to evaluate whole body posture and risks associated with job tasks (Hignett and McAtamney, 2000).
		Rapid Upper Limb Assessment (RULA)	Investigate exposure of individual worker to risk factors associated with work related upper limb disorders
		Job strain index (Moore Garg Job Strain Index)	Evaluates the strain the individual experiences as per the duration of task per day (task dependent) REF
Cognitive demands	Workload	NASA TLX	Subjective tool to measure cognitive workload (NASA, 2016).
	Office ergonomics	Rapid Office Strain Assessment (ROSA)	ROSA is a picture based posture checklist and chart scoring systems designed to screen and quantify exposure to risk factors in an office work environment. REF
		The ESA checklist	The ESA checklist is designed to identify hazards in office based tasks that may cause or aggravate musculoskeletal discomfort and decrease performance. It assesses risks associated with certain work postures. This tool assesses body posture in relation to different office equipment such as the chair, armrest, back support, monitor and telephone, the mouse and keyboard as well as the duration the worker interacts with this equipment's (Michael et al., 2012).
Environmental conditions	Temperature	Temperature data loggers	Temperature data loggers are electronic devices that record measurements, such as temperature or relative humidity, at set intervals over a period of time.
	Noise	Noise meter	A sound/noise level meter is commonly a hand-held instrument with a microphone that is used to measure acoustic (sound that travels through air).
	Lighting	Lux meter	A Lux meter is an instrument that measures the overall intensity of light within an environment for any given area or distance from the source.
Task analysis	Time motion studies	Stop watch	A stopwatch is a handheld timepiece designed to measure the amount of time elapsed from a particular time when it is activated to the time when the piece is deactivated.

CONDUCTING A BASELINE ERGONOMICS EVALUATION

ARMSCOR
Armaments Corporation of South Africa SOC Ltd

The methodology for the risk assessment

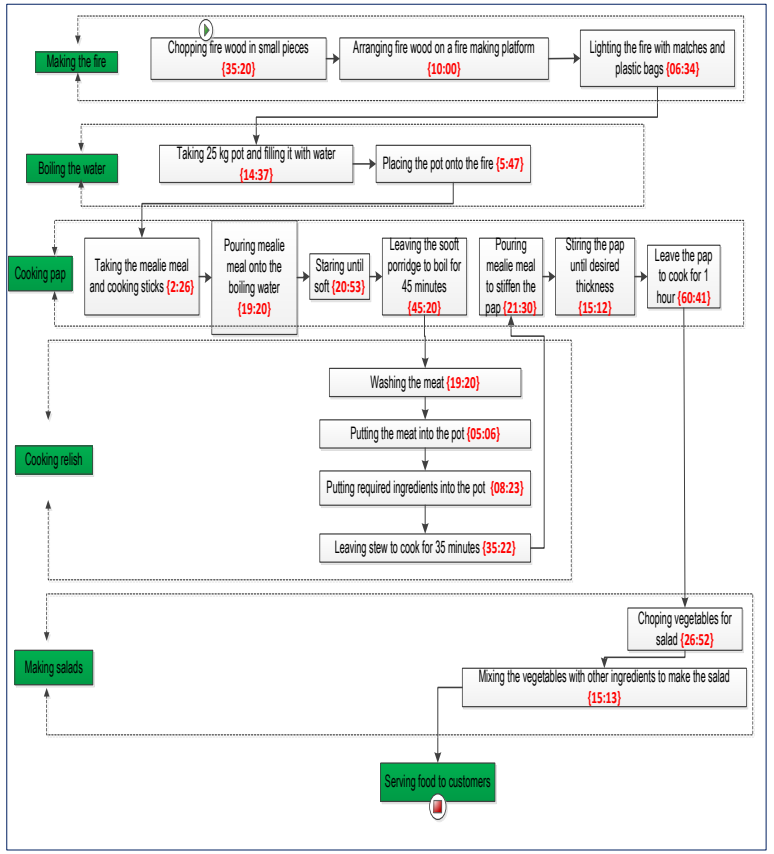
Informal interviews

Observational surveys

Walk-through survey

Ergonomics risk assessment checklist

Aspects of the system			Questions	Answer	Hazard	Probability	Consequence	Risk Ranking
TASK/ACTIVITIE	Physical demands	Task design	Does the task involve carrying heavy loads? (>23kg)	Y	Y	A	II	3
			Is there lifting of loads, tools or equipment?	Y	Y	A	II	3
			Is there pushing or pulling load, tools or equipment?	Y	Y	A	II	3
			Does the worker bend to handle loads, tools or equipment?	Y	Y	A	II	3
			Does the worker twist to handle loads, tools or equipment?	Y	Y	A	II	3
			Does the worker reach overhead for handle loads, tools or equipment while performing the task?	N	N			
			Does the worker operate tools or equipment above the shoulder height?	N	N			
			Does the worker climb stair or ladders while performing the task?	N	N			
			Does the worker stoop or squat while performing the task?	N	N			
			Does the task involve frequent repetitive motions?	N	N			
			Does the task involve continuous standing?	Y	Y	A	III	2
			Does the task involve continuous muscle contraction of limbs?	N	N			
			Does the task involve forceful exertions motions?	N	N			
			Does the worker kneel while performing the task?	N	N			
			Is the worker unable to change body position while performing a task?	N	N			
			Does the task require highly accurate movements?	N	N			
			Does the worker frequently bend any part of their body while performing a task?	Y	Y	A	II	3
			Does the worker adopt an awkward body posture while performing the task?	Y	Y	A	II	3
		Workspace design	Does the task require static muscular work?	N	N			
			Does the worker have limited space to perform their task?	N	N			
			Does the worker perform the task in confined spaces?	N	N			
			Is the worker able to sit or stand while performing the task?	Y	N			
			Does the workspace prohibit the worker from adopting a stable neutral posture?	N	N			
			Is the work performed at a height?	N	N			
		Tools/machines/displays/controls	Does foot control inhibit a suitable posture and balance?	n/a	n/a	n/a	n/a	n/a
			Is hand controls design restricting a good upper limb posture?	n/a	n/a	n/a	n/a	n/a
			Are controls located far from their corresponding displays?	n/a	n/a	n/a	n/a	n/a
			Does the worker have to monitor several displays at a time?	n/a	n/a	n/a	n/a	n/a
			Are there any restriction imposed by personal protective equipment?	n/a	n/a	n/a	n/a	n/a
			Are warning and instruction displays difficult to understand?	n/a	n/a	n/a	n/a	n/a
			Is the display language complex and not easily understandable?	n/a	n/a	n/a	n/a	n/a
			Is the worker exposed to vibration from the tool or equipment through the controls?	N	N			
			Is the worker exposed to vibration from the tool or equipment through the floor?	N	N			
			Is the location of the controls adjustable?	n/a	n/a	n/a	n/a	n/a
			Is the worker able to reach the controls?	n/a	n/a	n/a	n/a	n/a
			Is the worker able to operate the controls?	n/a	n/a	n/a	n/a	n/a
		Office/computer work	Does the worker use a computer for most of their working shift?	n/a	n/a	n/a	n/a	n/a
			Does the chair have a backrest?	n/a	n/a	n/a	n/a	n/a
			Is the seat height adjustable?	n/a	n/a	n/a	n/a	n/a
			Is the human computer interaction friendly?	n/a	n/a	n/a	n/a	n/a
			Is the seat cover material in good condition?	n/a	n/a	n/a	n/a	n/a
			Does the seat have armrest?	n/a	n/a	n/a	n/a	n/a
			Is the seat height and back of the chair adjustable?	n/a	n/a	n/a	n/a	n/a
			Is the workers' feet fully supported on the floor while sitting?	n/a	n/a	n/a	n/a	n/a
			Does the chair provide lower back support?	n/a	n/a	n/a	n/a	n/a
			Does armrest allow the worker to get close to the workstation?	n/a	n/a	n/a	n/a	n/a
			Are frequently used items far from the worker?	n/a	n/a	n/a	n/a	n/a
			Is the monitor adjustable?	n/a	n/a	n/a	n/a	n/a
			Is the monitor exposed to glare?	n/a	n/a	n/a	n/a	n/a
			Is the wrist bent when using the mouse or keyboard?	n/a	n/a	n/a	n/a	n/a
			Is the monitor positioned directly in front of the worker?	n/a	n/a	n/a	n/a	n/a
			Does the worker take less or no breaks?	n/a	n/a	n/a	n/a	n/a
			Are the complaints of discomfort from those working at the work station?	n/a	n/a	n/a	n/a	n/a
			Does the chair have lumbar support?	n/a	n/a	n/a	n/a	n/a
	Mental demands		Is the mental load of the task too low or too high?	N	N			
			Is the worker required to make high level individual decisions?	N	N			
			Are displays and controls complex and difficult to understand?	N	N			
			Does the task require integration of information from different modalities?	N	N			
			Does the worker perform more than one task at a time?	Y	N			

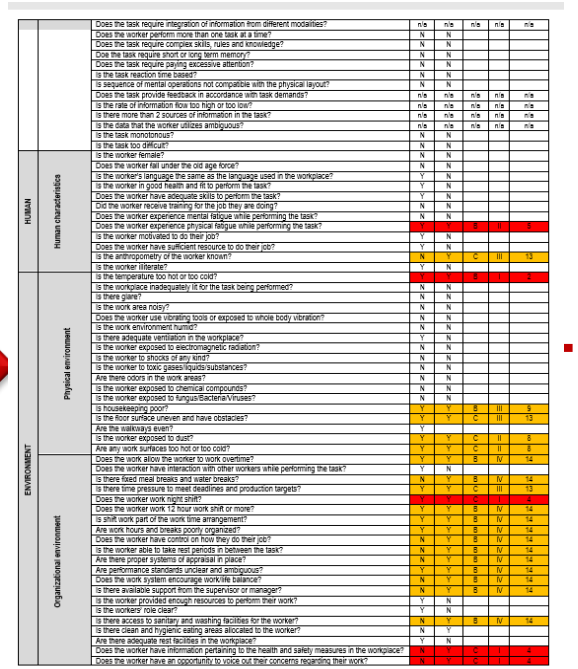


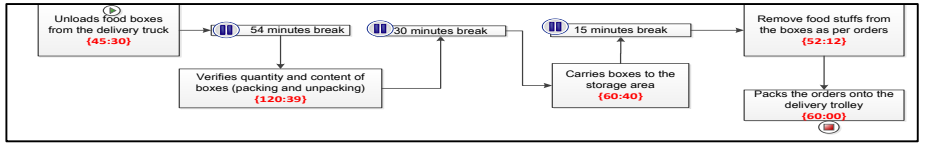
Hierarchical task analysis for the food preparation task ({00:00} represents time in {minutes: seconds})

	ERGONOMICS SCREENING TOOLS		CHARACTERISTICS
Physical demands	Manual Materials Handling tasks	Liberty Mutual Tables for lifting, carrying, pushing and pulling	These tables are used for setting weight limits for lifting, carrying, pulling and pushing tasks. The tables use frequency, location of load in relation to the body while performing the task and the distance travelled while handling the load. (Snook and Ciriello, 1991).
		NIOSH lifting equation	The NIOSH equation was developed by the National Institute for Occupational Safety and Health. This equation is used for setting weight limits for asymmetric lifting tasks (Dempsey et al, 2005)).
	Exertion and discomfort	Body discomfort map and scale	The Body discomfort scale is a basic tool that is used to identify any discomfort associated with the task been performed (Wilson and Corlett, 1992).
		Standard Nordic Musculoskeletal Questionnaire	Identifies more with recent than older and less serious musculoskeletal disorder (Kuorinka and Forcier 1995)
		Rating of perceived exertion	The modified Borg rating of perceived exertion is a way of measuring physical activity intensity level (Scott, 2009).
		Cornell Musculoskeletal Questionnaire	Evaluates task to identify possibility of musculoskeletal disorder prevalence and applicable to sedentary and standing work (Hedge et al., 1999)
		Cornell Musculoskeletal Hand Questionnaire	Evaluates tasks to identify possibility of musculoskeletal disorders prevalence and applicable to hand symptoms (Hedge et al., 1999)
	Working posture and repetitive Tasks	Rapid Entire Body Assessment (REBA)	Rapid Entire Body Assessment (REBA) is an ergonomic assessment tool which utilizes a systematic process to evaluate whole body posture and risks associated with job tasks (Hignett and McAtamney, 2000).
		Rapid Upper Limb Assessment (RULA)	Investigate exposure of individual worker to risk factors associated with work related upper limb disorders McAtamney, L. and Corlett, E.N. 1993.
		Job strain index (Moore Garg Job Strain Index)	Evaluates the strain the individual experiences as per the duration of task per day (task dependent) (Moore and Garg, 1995)
Cognitive demands	Workload	NASA TLX	Subjective tool to measure cognitive workload (NASA, 2016).
	Office ergonomics	Rapid Office Strain Assessment (ROSA)	ROSA is a picture based posture checklist and chart scoring systems designed to screen and quantify exposure to risk factors in an office work environment. (Sonne, et al., 2012).
		The ESA checklist	The ESA checklist is designed to identify hazards in office based tasks that may cause or aggravate musculoskeletal discomfort and decrease performance. It assesses risks associated with certain work postures. This tool assesses body posture in relation to different office equipment such as the chair, armrest, back support, monitor and telephone, the mouse and keyboard as well as the duration the worker interacts with this equipment's (www.ergosystems.ca/images/pdf/Office%20Ergonomics%20Hazard%20Checklist.).
Environmental conditions	Temperature	Temperature data loggers	Temperature data loggers are electronic devices that record measurements, such as temperature or relative humidity, at set intervals over a period of time.
	Noise	Noise meter	A sound/noise level meter is commonly a hand-held instrument with a microphone that is used to measure acoustic (sound that travels through air).
	Lighting	Lux meter	A Lux meter is an instrument that measures the overall intensity of light within an environment for any given area or distance from the source.
Task analysis	Time motion studies	Stop watch	A stopwatch is a handheld timepiece designed to measure the amount of time elapsed from a particular time when it is activated to the time when the piece is deactivated.

EXAMPLE OF A RISK ASSEMENT

ARMSCOR
Armaments Corporation of South Africa SOC Ltd





STEP 1: MEASURE AND RECORD TASK VARIABLES

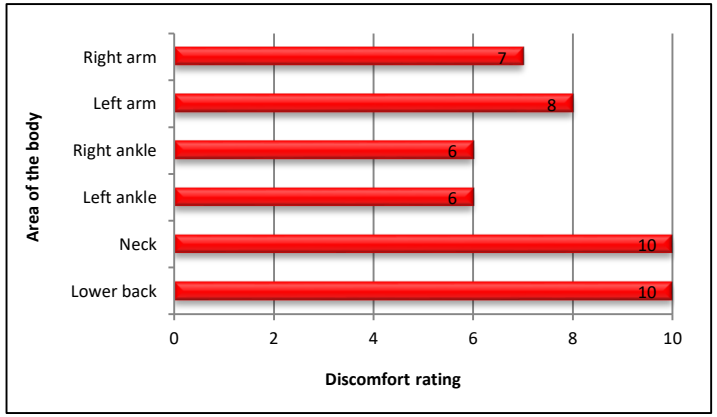
Object weight (KG)		Hand location				Vertical distance	Asymmetric angel (degree)		Frequency rate	Duration	Object coupling
L (AVG)	L (MAX)	Origin		Destination			Origin	Destination	Lifts/min	Hrs	
		H	V	H	V	D	A	A	F		C
22	22	61	40	32	51	23	0	0	1	6	Poor

STEP 2: DETERMINING THE MULTIPLIERS AND COMPUTER THE RWL

	RWL =	LC	X	HM	X	VM	X	DM	X	AM	X	FM	X	CM		
Origin:	RWL =	22	X	0.42	X	0.93	X	0.91	X	1	X	0.35	X	0.90	=	2.5
Destination:	RWL =	22	X	0.78	X	0.85	X	0.91	X	1	X	0.35	X	0.90	=	4.2

STEP 3: COMPUTING THE LIFTING INDEX

ORIGIN:	LIFT INDEX	OBJECT WEIGHT /RWL = 22/2.5 =	8.8
DESTINATION:	LIFT INDEX	OBJECT WEIGHT /RWL = 22/4.2 =	5.2



RESULTS FOR ASSESSING EXERTION AND DISCOMFORT

Tasks	Body posture	Neck score	Trunk score	Leg score	Posture score A	Force load score	Score A	Upper arm score	Lower arm score	Wrist score	Posture score B	Coupling score	Score B	Table C score	Activity score	REBA score
Carrying boxes	Walking	2	3	2	5	1	6	2	2	2	3	2	5	8	1	9
Opening boxes on the floor	Standing	2	4	1	5	1	6	2	1	2	2	2	4	7	1	8
Unpacking content of the boxes	Standing	1	4	1	3	1	4	2	2	2	3	2	5	5	1	6

Frequency		Distance of carry (m)		
		2.1	4.3	8.5
1/8 h	1/8 h	21	21	19
1/30 min	2/ 1 h	16	16	14
1/5 min	12 /1 h	16	16	14
1 / 2 min	30/ 1 h	15	15	14
1/ 1 min	1/ 1 min	15	15	14
1/20 s	3/1 min	14	12	12
1/ 10 s	6/1 min	13	11	OR

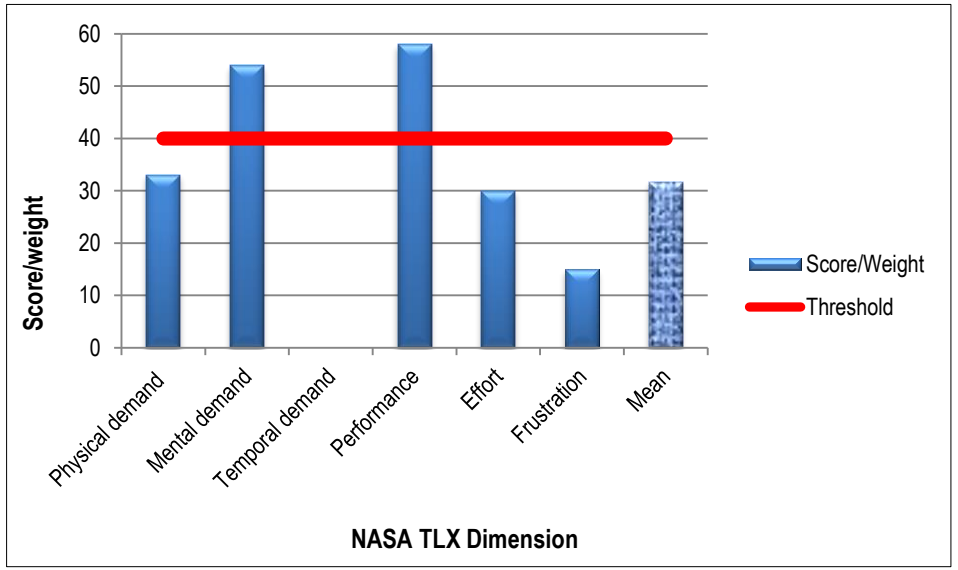
RESULTS FOR ASSESSING MANUAL MATERIALS HANDLING TASKS

EXAMPLE OF A RISK ASSEMENT

ARMSCOR
Armaments Corporation of South Africa SOC Ltd

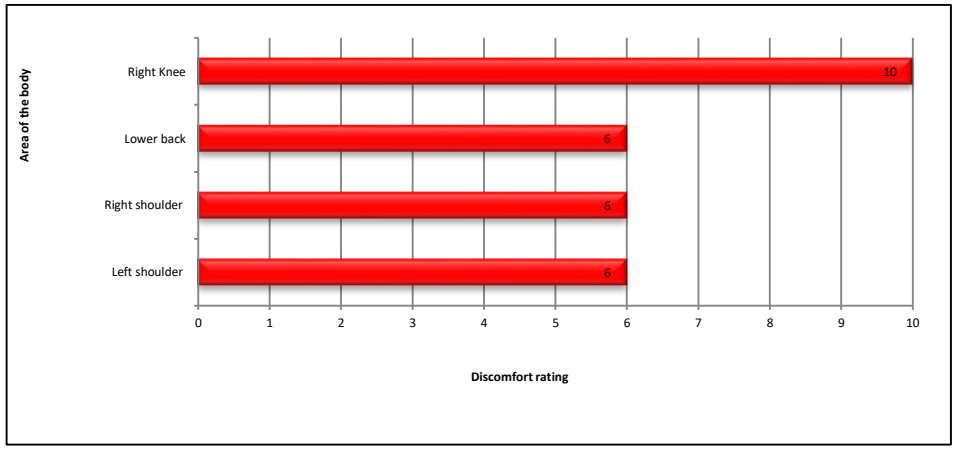
Frequency		Push distance (m) 2.1 Initial	2.1 Sustained	7.6 Initial	7.6 Sustained	15.2 Initial	15.2 Sustained	30.5 Initial	30.5 Sustained	45.7 Initial	45.7 Sustained	61.0 Initial	61.0 Sustained
1/8 h	1/8 h	27	19	25	17	21	14	21	13	21	12	19	9
1/30 min	2/1 h	25	16	23	13	20	11	19	10	19	9	17	7
1/5 min	12/1 h	24	15	22	13	19	11	18	9	18	8	16	6
½ min	30/1 h	22	13	20	11	17	10	16	9	16	8	15	6
1/1 min	1/1 min	21	13	20	11	17	9	15	8	15	7	OR	OR
1/30 s	2/1 min	20	13	19	10	16	8	OR	OR	OR	OR	OR	OR
1/15 s	4/1 min	19	12	17	9	OR	OR	OR	OR	OR	OR	OR	OR
1/12 s	5/1 min	18	11	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR
1/6 s	10/1 min	17	6	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR

RESULTS FOR ASSESSING MANUAL MATERIALS HANDLING TASKS



Tasks	Body posture	Neck score	Trunk score	Leg score	Posture score A	Force load score	Score A	Upper arm score	Lower arm score	Wrist score	Posture score B	Coupling score	Score B	Table C score	Activity score	REBA score
Loading boxes onto the trolley	Walking	2	3	2	5	1	6	2	2	2	3	2	5	8	1	9
Pushing trolley around stalls	Walking	1	1	2	2	1	3	2	2	2	3	2	5	4	0	4
Offloading boxes	Standing	1	4	2	5	1	6	2	1	2	2	2	4	7	0	7

RESULTS FOR ASSESSING EXERTION AND DISCOMFORT



RESULTS FOR ASSESSING WORKING POSTURE AND REPETITIVE TASKS

CONCLUSION

Ergonomics and human factors has and continue to play an important role in minimizing the impact COVID-19 has on the workers and the workplace (productivity)

- Protect the workers against adverse effects
- Optimise performance
- Workplace design
- Ergonomics knowledge and training
- Design of masks

ARMSCOR
Armaments Corporation of South Africa SOC Ltd

THANK YOU

Lesedi Milanzi (Ergonomics consultant)
Ergonomics Technologies a Division of Armscor SOC Ltd
ERGOTECH,103 Combretum Crescent| Highveld Park | Centurion | Gauteng
ERGOTECH | PO Box 6264 | Pretoria | South Africa 0001
Tel: +27 12 665 9407 | Fax: +27 12 665 0787 | Cell: +27 720662015
E-mail: lesedim@ergotech.co.za, web www.ergotech.co.za