FORTEe europe

Funded by the European Union

# EXERCISE TESTING PROTOCOLS IN CHILDREN WITH CANCER

FRANCESCA LANFRANCONI, ELEONORA CORTI, BARBARA KONDA, WILLIAM ZARDO, TOMMASO MORIGGI, ELIAS DREISMICKENBECKER, MARIE NEU, CARMEN FIUZA LUCES, ALEJANDRO LUCÍA, JÖRG FABER, ADRIANA BALDUZZI
ON BEHALF OF THE FORTEe CONSORTIUM

# EXERCISE TESTING PROTOCOLS IN CHILDREN WITH CANCER

FONDAZIONE MONZA E BRIANZA
PER IL BAMBINO E LA SUA MAMMA
CENTRO MARIA LETIZIA VERGA,
MONZA (ITALY)

Francesca Lanfranconi
William Zardo
Tommaso Moriggi
Eleonora Corti
Emanuele Villa
Giorgia Radaelli
Monica Barbieri
Adriana Balduzzi

UNIVERSITÄTSMEDIZIN DER JOHANNES
GUTENBERG-UNIVERSITÄT MAINZ,
MAINZ (GERMANY)

Elias Dreismickenbecker
Marie Neu
Jörg Faber

UNIVERSIDAD EUROPEA DE MADRID SAU,
MADRID (SPAIN)

Alejandro Lucía

INSTITUTO DE INVESTIGACIÒN SANITARIA
HOSPITAL 12 DE OCTUBRE ('IMAS12')

Carmen Fiuza Luces



Funded by the European Union

# EXERCISE TESTING PROTOCOLS IN CHILDREN WITH CANCER

FRANCESCA LANFRANCONI, WILLIAM ZARDO, TOMMASO MORIGGI,
ELEONORA CORTI, ELIAS DREISMICKENBECKER, MARIE NEU,
CARMEN FIUZA LUCES, ALEJANDRO LUCIA, ADRIANA BALDUZZI,
JÖRG FABER
ON BEHALF OF THE FORTEe CONSORTIUM

FORUM

**Art director**
Francesca Lanfranconi, Eleonora Corti, Paola Limonta

**Designers and illustration managers**
Eleonora Corti, Sara Mangola

**Photographers**
Eleonora Corti, Sara Mangola

**English reviewers**
Caterina Lanfranconi



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 945153.

*Publication by*
Forum Editrice Universitaria Udinese
FARE srl con unico socio
Via Palladio, 8 – 33100 Udine
Tel. 339 0432 26001
www.forumeditrice.it

Udine (Italy) 2026

ISBN 978-88-3283-638-7 (pdf)



## Dedicated to

our children, adolescents, and young adults fighting cancer and dreaming strong from their hospital beds.
To the families and friends who stand with them, sustaining the fight and turning those beds into places where dreams take flight.

Your exercise team




## ABOUT THE FORTEe EU PROJECT

FORTEe is an international multicentre scientific research project involving 16 institutions in 8 European countries – Spain, Italy, Germany, England, France, Romania, Slovenia and Denmark – coordinated by the Universitätsmedizin der Johannes Gutenberg-Universität Mainz, Mainz (Germany).
Fondazione Monza e Brianza per il bambino e la sua mamma, Monza (Italy), is the leader of the clinical trial testing and intervention protocol. There will be 450 children, adolescents and young adults – the so-called 'CAYA-c' – with blood or solid organs cancer recruited in the centres participating in the project in various countries, with the aim of demonstrating that precision-based exercise is safe and can support cancer treatment.
During cancer treatments CAYA-c face problems related to the disease itself, cancer treatments and forced immobility (bed rest). Exercise and sports, supervised and adapted daily to the clinical conditions of these patients, seem to be a valuable aid in their course of therapy. However, the impact of precision training in CAYA-c with cancer has still limited evidence.
The FORTEe research project fits into this knowledge gap and aims to demonstrate that exercise and sports are a safe and potentially effective to counteract fatigue, maintain strength, aerobic capacity, coordination, and agility, and to improve the quality of life of CAYA-c. In addition, there is preliminary evidence that improved efficiency of the systems that serve to perform exercise, such as the heart, lung, and skeletal muscle system, can support the immune system in the fight against cancer, in synergy with oncology drugs and treatments.
Furthermore, FORTEe also aims to develop innovative digital technologies, such as an augmented reality app, to increase motivation and engagement of CAYA-c, and to implement guidelines for the realisation of exercise and sports as therapy in children's hospitals in Europe and worldwide.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 945153.

This booklet reflects only the Author's view and the European Commission is not responsible for any use that may be made of the information it contains.

## ABOUT THE FORTEe TEAM AT
## FONDAZIONE MONZA E BRIANZA PER IL BAMBINO E LA SUA MAMMA, MONZA (ITALY)

PEDIATRICIANS

SPORTS MEDICINE DOCTORS

PEDIATRIC RESIDENTS

EXERCISE PROFESSIONALS

OSTEOPATHS

TECHNICAL INSTRUCTORS

NURSES

THESIS STUDENTS

FAMILIES COMMITTEE

SOCIAL MEDIA MANAGERS

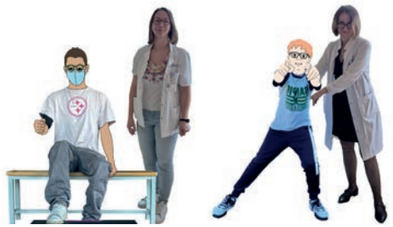


## ABOUT THE FORTEe TEAM AT
## UNIVERSITÄTSMEDIZIN DER JOHANNES GUTENBERG-UNIVERSITÄT MAINZ, MAINZ (GERMANY)

PEDIATRICIANS

EXERCISE PROFESSIONALS

## ABOUT THE FORTEe TEAM AT FORMA 3D LTD. & UNIVERZITETNI KLINIČNI CENTER LJUBLJANA, LJUBLJANA (SLOVENIA)



PEDIATRICIANS

EXERCISE PROFESSIONALS

PROJECT MANAGERS



## ABOUT THE FORTEe TEAM AT UNIVERSIDAD EUROPEA DE MADRID SAU, MADRID (SPAIN)

PEDIATRICIANS

SPORTS MEDICINE DOCTORS

REHABILITATION DOCTORS

EXERCISE PROFESSIONALS

BIOLOGY AND EXERCISE RESEARCHES

LABORATORY TECHNICIANS

NURSES

## ABOUT THE FORTEe TEAM AT FONDAZIONE IRCCS ISTITUTO NAZIONALE DEI TUMORI, MILANO (ITALY)

PEDIATRICIANS

PHYSIOTHERAPISTS

EXERCISE PROFESSIONALS

## ABOUT THE FORTEe TEAM AT OXFORD BROOKES UNIVERSITY, OXFORD (ENGLAND)

EXERCISE PROFESSIONALS

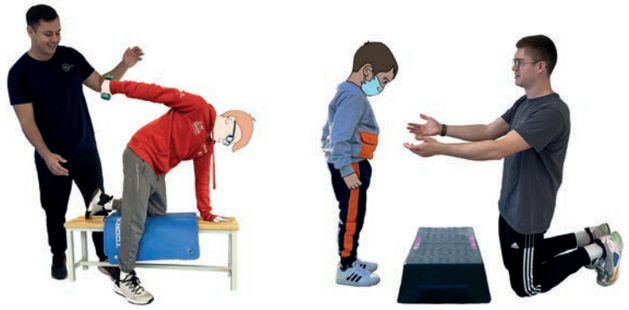
## ABOUT THE FORTEe TEAM AT UNIVERSITÄTSKLINIKUM HEIDELBERG, HEIDELBERG (GERMANY)

EXERCISE PROFESSIONALS

## ABOUT THE FORTEe TEAM AT UNIVERSITÄTSKLINIKUM ESSEN, ESSEN (GERMANY)

OCCUPATIONAL THERAPISTS

EXERCISE PROFESSIONALS



SPORT SCIENCE STUDENTS



## ABOUT THE FORTEe TEAM AT CENTRE DE LUTTE CONTRE LE CANCER LÉON BÉRARD, LYON (FRANCE)

EXERCISE PROFESSIONALS

## ABOUT THE FORTEe TEAM AT REGION HOVEDSTADEN, COPENHAGEN (DENMARK)

EXERCISE PROFESSIONALS

# CONTENTS



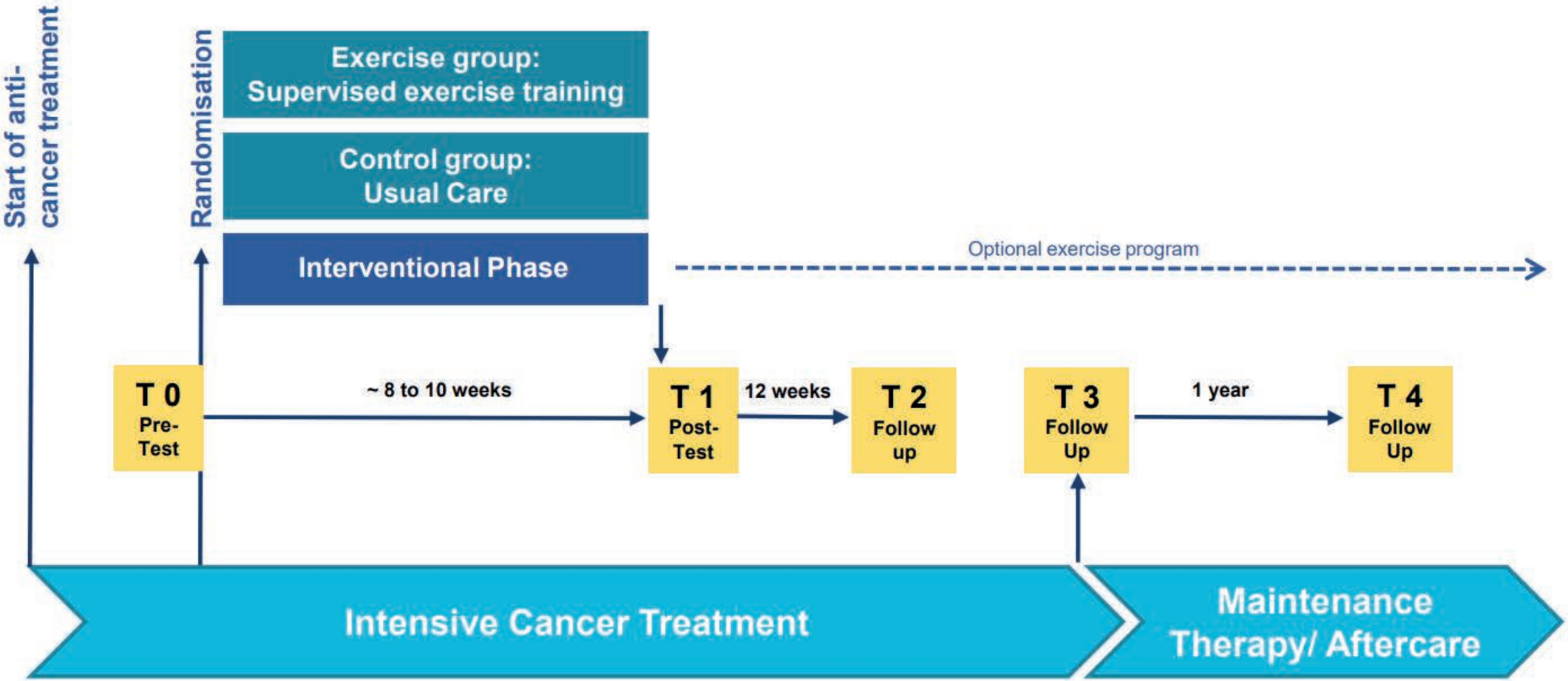


# CONTENTS

# CONTENTS



EXERCISE TESTING PROTOCOLS TIMELINE

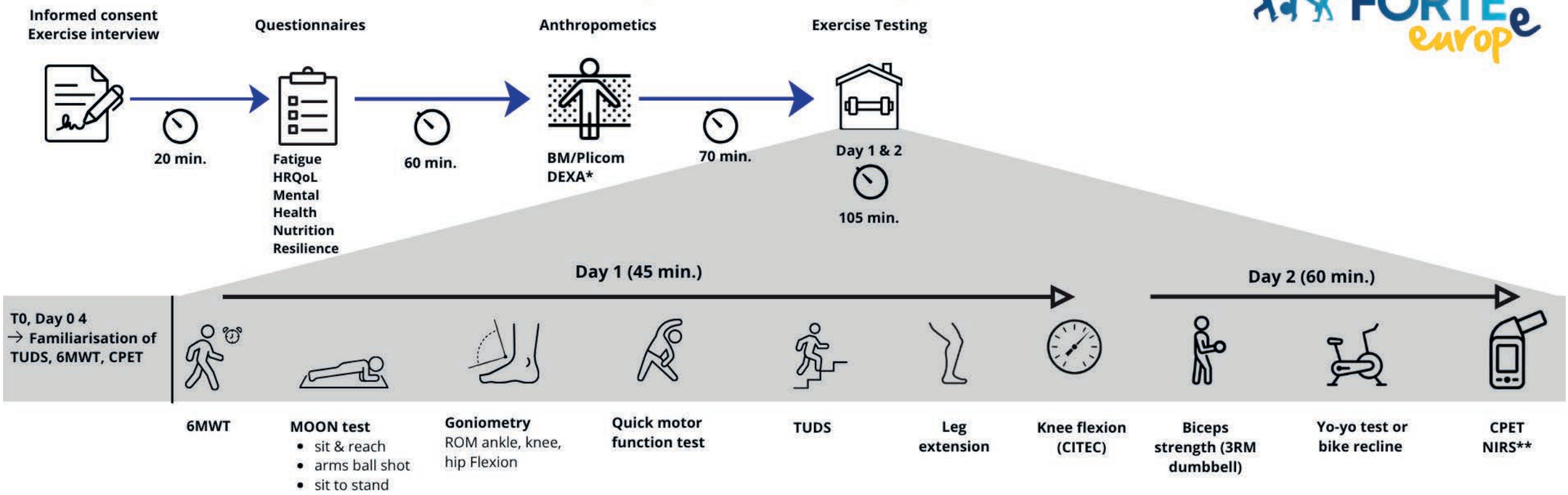



**Study design of the randomised controlled FORTEe trial**

| | |
|---|---|
| T0 | Start of intervention, Pre-Test |
| T1 | End of intervention, Post-Test |
| T2 | First follow-up, 12 weeks after T1 |
| T3 | Second follow-up, at the end of intensive cancer treatment |
| T4 | Third follow-up, 12 months after being in maintenance or in stop theraphy |

EXERCISE TESTING PROTOCOLS TIMELINE

## Study flow and Timepoints



## EXERCISE TESTING PROTOCOLS TIMELINE

Within four weeks from the diagnosis the investigator will consult with the pediatric oncologist and review the participant's medical history. Subsequently, the investigator will provide the informed consent form to the family and will collect it no sooner than 48 hours later. Both parents and the child may agree to participate in the FORTEe research project and return the signed informed consent form.

Each participant enrolled in the study will complete exercise testing sessions and questionnaires at five time point:

1. before the intervention (T0);
2. after 8-10 weeks of training or standard care (control group) (T1);
3. 12 weeks after the end of the intervention (T2);
4. at the start of the maintenance phase or at stop therapy (T3; questionnaires only);
5. one year after T3 (T4; questionnaires only).

All evaluation sessions must be supervised by an exercise professional after medical clearance. Nursing staff will provide cancer treatment avoiding conflicts with exercise testing sessions.



## EXERCISE TESTING PROTOCOLS TIMELINE

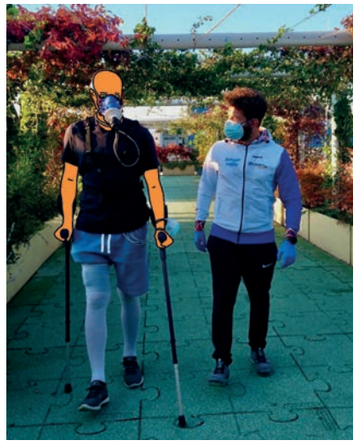
### T0-T1

**Day 0**

Only at T0, a familiarisation session for the main exercise testing evaluation will be conducted (i.e. 6 Minute Walk Test 6MWT, Cardiopulmonary Exercise test CPET, Time Up and Down Stairs TUDS).
The child and the parents will complete the following questionnaires: Mainz Resilience Score in childhood cancer (MRScc), Child & Youth Resilience Measure – Revised (CYRM-R), Brief Resilience Scale (BRS), General Self-Efficacy Scale (GSE), Physical Exercise Self-Efficacy Scale (PESE), Modified Youth Physical Activity Questonnaire (mYPAQ), WHO (Five) Well-Being-Index, The Warwick-Edinburgh Mental Well-being-Scale (WWMWBS), PedsQL fatigue, PedsQL cancer and PedsQL quality of life.
At T0-T1 a Half-Structured Interview on Physical Activity, the anthropometric assessment using BIA and skinfold measurements will be conducted. If the child is hospitalised, the interview and administration of the questionnaires will be carried out in the hospital room.

**Day 1**

The Stand/Sit and Reach Test, Medicine Ball Shot Test, and quadriceps strength assessment using a leg extension machine are performed in a gym when it is possible. The TUDS test is performed on the stairs of the hospital and 6MWT is also performed.
The Quick Motor Function (QUICK), quadriceps, hamstrings and biceps strength test (CITEC), Sit-to-Stand Test, and range of motion (ROM) assessment are performed in the gym or, if the child is hospitalised, in the rooms of the wards.



**Day 2**

An incremental CPET to exhaustion, performed on a cycle ergometer or by a walking shuttle test, will be conducted in the gym when it is possible, under medical su-

pervision. Heart rate must be continuously recorded using a 10-lead ECG. Arterial blood pressure must be measured using a manual sphygmomanometer. Breath-by-breath pulmonary gas exchange and ventilation must be monitored using a metabolic cart, and maximal aerobic capacity ($VO_2$peak) must be determined.
The NIRS probe, composed of an emitter and detector pair, must be firmly placed on the skin over the lower third of the right vastus lateralis muscle (10 cm above the proximal border of the patella and 3 cm lateral to the midline of the thigh) and secured with Velcro straps. Elastic bandages must be applied around the probe to prevent interference from ambient light. Skinfold thickness at the NIRS application site must be measured before the exercise protocol using callipers.
Ischaemia must be induced by asking the child to extend the knee against resistance for 1-2 minutes while seated on a leg extension machine. Arterial oxygen saturation ($SaO_2$) must be monitored via pulse oximetry.
Biceps brachii strength must also be assessed in the gym.

## T2

### Day 0

The child and the parents will complete the following questionnaires: Mainz Resilience Score in childhood cancer (MRScc), Child & Youth Resilience Measure – Revised (CYRM-R), Brief Resilience Scale (BRS), General Self-Efficacy Scale (GSE), Physical Exercise Self-Efficacy Scale (PESE), Modified Youth Physical Activity Questonnaire (mYPAQ), WHO (Five) Well-Being-Index, The Warwick-Edinburgh Mental Well-being-Scale (WWMWBS), PedsQL fatigue, PedsQL cancer and PedsQL quality of life.
At T2 a Half-Structured Interview on Physical Activity and the anthropometric assessment using BIA will be conducted. If the child is hospitalised, the interview and administration of the questionnaires will be carried out in the hospital room.

### Day 1

The Stand/Sit and Reach Test is performed in a gym when it is possible. 6MWT is also performed.





The Quick Motor Function (QUICK), Sit-to-Stand Test, The quadriceps, hamstrings and biceps strength test (CITEC) are performed in the gym or, if the child is hospitalised, in the rooms of the wards.

### Day 2

An incremental CPET to exhaustion, performed on a cycle ergometer or by a walking shuttle test , will be conducted in the gym when it is possible, under medical supervision. Heart rate must be continuously recorded using a 10-lead ECG. Arterial blood pressure must be measured using a manual sphygmomanometer. Breath-by-breath pulmonary gas exchange and ventilation must be monitored using a metabolic cart, and maximal aerobic capacity ($VO_2$peak) must be determined.
The NIRS probe, composed of an emitter and detector pair, must be firmly placed on the skin over the lower third of the right vastus lateralis muscle (10 cm above the proximal border of the patella and 3 cm lateral to the midline of the thigh) and secured with Velcro straps. Elastic bandages must be applied around the probe to prevent interference from ambient light. Skinfold thickness at the NIRS application site must be measured before the exercise protocol using callipers.
Ischaemia must be induced by asking the child to extend the knee against resistance for 1–2 minutes while seated on a leg extension machine. Arterial oxygen saturation ($SaO_2$) must be monitored via pulse oximetry.

## T3-T4

### Day 0

The child and the parents will complete the following questionnaires: Mainz Resilience Score in childhood cancer (MRScc), Child & Youth Resilience Measure – Revised (CYRM-R), Brief Resilience Scale (BRS), General Self-Efficacy Scale (GSE), Physical Exercise Self-Efficacy Scale (PESE), Modified Youth Physical Activity Questonnaire (mYPAQ), WHO (Five) Well-Being-Index, The Warwick-Edinburgh Mental Well-being-Scale (WWMWBS), PedsQL fatigue, PedsQL cancer and PedsQL quality of life.

At T3-4 a Half-Structured Interview on Physical Activity will be conducted.

## EXERCISE TESTING PROTOCOLS TIMELINE


Corder K, van Sluijs EM, Wright A, Whincup P, Wareham NJ, Ekelund U. Is it possible to assess free-living physical activity and energy expenditure in young people by self-report? Am J Clin Nutr. 2009 Mar;89(3):862-70. doi: 10.3945/ajcn.2008.26739. Epub 2009 Jan 14. PMID: 19144732.

Jefferies P, McGarrigle L, Ungar M. The CYRM-R: A Rasch-Validated Revision of the Child and Youth Resilience Measure. J Evid Based Soc Work (2019). 2019 Jan-Feb;16(1):70-92. doi: 10.1080/23761407.2018.1548403. Epub 2018 Nov 25. PMID: 30472932.

Neu MA, Ortmüller F, Robinson AL, Dreismickenbecker E, Otto H, Wypyrsczyk L, Kühn M, Wessa M, Tüscher O, Faber J; FORTEe Consortium. The mainz resilience assessment in childhood cancer (MRAcc): development of a novel age-specific patient-reported outcome measure to assess resilience in childhood cancer patients. BMC Cancer. 2026 Feb 26;26(1):312. doi: 10.1186/s12885-026-15776-y. PMID: 41749123; PMCID: PMC12952046.

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman, S. Wright, & M. Johnston, Measures in health psychology: A user's portfolio. Causal and control beliefs (pp. 35-37). Windsor, UK: NFER-NELSON.

Schwarzer R. and Renner B. (2009). Health-specific self-efficacy scales. Freie Universität Berlin.

Smith BW, Dalen J, Wiggins K, Tooley E, Christopher P, Bernard J. The brief resilience scale: assessing the ability to bounce back. Int J Behav Med. 2008;15(3):194-200. doi: 10.1080/10705500802222972. PMID: 18696313.

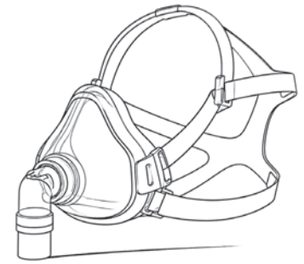
Tennant R, Hiller L, Fishwick R, Platt S, Joseph S, Weich S, Parkinson J, Secker J, Stewart-Brown S. The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): development and UK validation. Health Qual Life Outcomes. 2007 Nov 27;5:63. doi: 10.1186/1477-7525-5-63. PMID: 18042300; PMCID: PMC2222612.

Topp CW, Østergaard SD, Søndergaard S, Bech P. The WHO-5 Well-Being Index: a systematic review of the literature. Psychother Psychosom. 2015;84(3):167-76. doi: 10.1159/000376585. Epub 2015 Mar 28. PMID: 25831962.

Varni JW, Burwinkle TM, Katz ER, Meeske K, Dickinson P. The PedsQL in pediatric cancer: reliability and validity of the Pediatric Quality of Life Inventory Generic Core Scales, Multidimensional Fatigue Scale, and Cancer Module. Cancer. 2002 Apr 1;94(7):2090-106. doi: 10.1002/cncr.10428. PMID: 11932914.




# EXERCISE TESTING PROTOCOLS



# CARDIOPULMONARY EXERCISE TEST (CPET)

It is used to evaluate the individual's capacity to perform repeated intense exercise.

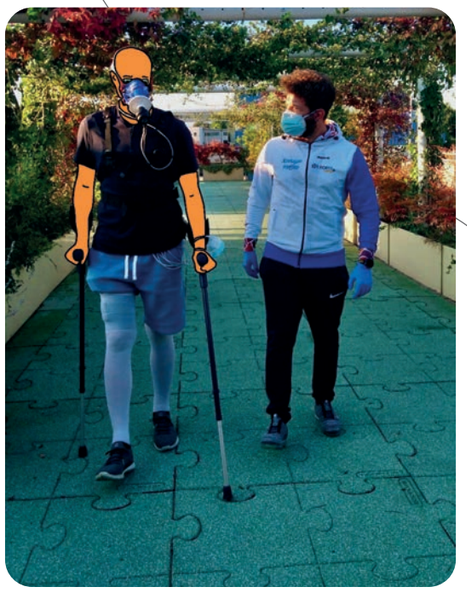
## EQUIPMENT

1 Yo-yo test audio track.
1 Speaker.
1 Pulse oximeter.
1 Evaluation grid.
1 Pen.
1 10-Lead electrocardiography monitor*.
1 Computerized metabolic cart*.
1 Near-infrared spectroscopy device*.
1 Skinfold caliper*.
1 Cycle ergometer#.

* discretionary
\# in case of inability to walk

## HUMAN RESOURCES

2 Exercise professionals.





CARDIOPULMONARY EXERCISE TEST (CPET)

## PROTOCOL

The Yo-Yo adapted test is a CPET that consists of repeated shuttle runs over a 20 m distance (out-and-back), performed at pre-established speeds, with each shuttle followed by 10 seconds of passive recovery.
Shuttle timing is dictated by acoustic signals from an audio track, which indicate the start of each shuttle and the recovery intervals between shuttles (e.g., double beep: start and run 20 m; single beep: turn and return 20 m; signal: recovery phase; double beep: start of a new shuttle). Speed increments are announced by a recorded voice indicating the new pace (e.g., "you are now running at 4 km/h"). The test is terminated when the participant fails to reach the required distance within the audio signal for two consecutive shuttles. At that point, the test is considered completed due to exhaustion. Performance is defined as the total distance covered.
No verbal encouragement from exercise professional is permitted during the test. Heart rate (HR) and oxygen saturation ($SaO_2$) are monitored using pulse oximetry every 40 m.

## ALTERNATIVE

In cases of lower limb motor impairment, the test shall be conducted using a recumbent cycle ergometer.

## SAFETY MEASURES

To minimise the risk of injury due to falls, playground safety standards requiring the use of soft play surfaces will be applied.

1
EXERCISE TESTING PROTOCOLS / FUNCTIONAL CAPACITY AND PERFORMANCE

# CARDIOPULMONARY EXERCISE TEST (CPET)

## GAS EXCHANGE AND PULMONARY VENTILATION

CPET can be performed by measuring gas exchange, pulmonary ventilation and skeletal muscle oxygen extraction. Oxygen uptake ($VO_2$), carbon dioxide production ($VCO_2$), and substrate oxidation are determined breath-by-breath using a wearable metabolic system. For accurate calculations, tidal volume and the expiratory fractions of oxygen and carbon dioxide must be time-aligned, accounting for their respective signal delays.



CARDIOPULMONARY EXERCISE TEST (CPET)

## OUTCOMES

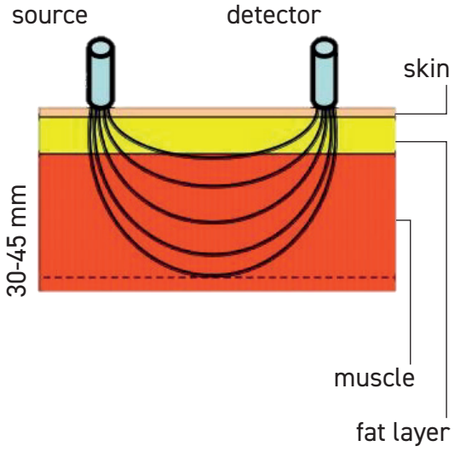
| SYMBOL | NAME | U.M. |
|---|---|---|
| Distance or power | Workload | m or W |
| $VO_2$ | Oxygen uptake | (mL/Kg/min) |
| $VCO_2$ | Carbon dioxide production | (L/min) |
| VE BTPS | Ventilatory exchange | (L/min) |
| $EqO_2$ | Oxygen equivalent | |
| $EqCO_2$ | Carbon dioxide equivalent | |
| VtBTPS | Tidal volume | (L) |
| RR | Respiratory rate (breath/min) | bpm |
| $PETO_2$ | Pulmonary end tidal oxygen tension | (mmHg) |
| $PETCO_2$ | Pulmonary end tidal carbon dioxide tension | (mmHg) |
| RER | Respiratory exchange ratio | |
| HR | Heart rate (beat/min) | bpm |
| Score | Borg scale | n° |
| $SaO_2$ | Arterial oxygen saturation | % |

1
EXERCISE TESTING PROTOCOLS / FUNCTIONAL CAPACITY AND PERFORMANCE

# CARDIOPULMONARY EXERCISE TEST (CPET)

## MUSCLE $O_2$ EXTRACTION

Near-Infrared Spectroscopy is a non-invasive method that allows the monitoring of muscle oxygenation on the principle that the near-infrared light absorption characteristics of haemoglobin (Hb) and myoglobin (Mb) depend on their $O_2$ saturation. The NIRS probe, composed of an emitter and detector pair, is firmly placed on the skin over the lower third of the right vastus lateralis muscle (10 cm above the proximal border of the patella and 3 cm lateral to the midline of the thigh), and secured with a belt of Velcro straps. Elastic bandages are put around the muscle probe to prevent contamination from localised light. Skinfold thickness at the site of application of the NIRS probe is determined before the exercise protocol by a calliper. Muscle Δ[HHb] data will be expressed as a percentage of the maximal deoxygenation reference point obtained by a post-exercise isometric ischaemia technique (Δ[HHb]/Δ[HHb]isch). Ischaemia is obtained by asking the child to extend her/his knee against a resistance for 1-2 minutes, while sitting on a leg extension machine. The final reading is taken when detection of simultaneous increase of Δ[HHb] and corresponding decrease in Δ[$HbO_2$] reaches a plateau.






CARDIOPULMONARY EXERCISE TEST (CPET)

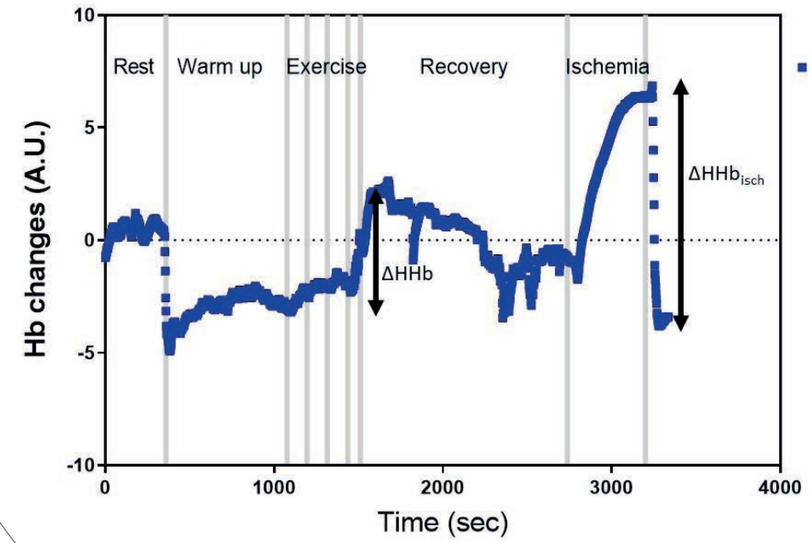


MUSCLE $O_2$ EXTRACTION

### OUTCOMES

| SYMBOL | NAME | U.M. |
|---|---|---|
| ΔHHb/ΔHHbisch | (Peak - basal deoxygenated haemoglobin)/(peak - basal ischemic deoxygenated haemoglobin) | Arbitrary units |

### Δ[HHb]/Δ[HHbisch]




Lanfranconi F., Pollastri L., Ferri A., Fraschini D., Masera G., Miserocchi G. (2014), "Near infrared spectroscopy (NIRS) as a new non-invasive tool to detect oxidative skeletal muscle impairment in children survived to acute lymphoblastic leukaemia". Plos One, 9(6).

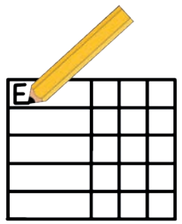
Zardo W., Villa E., Corti E., Moriggi T., Radaelli G., Ferri A., Marzorati M., Eirale C., Vago P., Biondi A., Jankovic M., Balduzzi A., Lanfranconi F. (2022), "The Impact of a Precision-Based Exercise Intervention in Childhood Hematological Malignancies Evaluated by an Adapted Yo-Yo Intermittent Recovery Test. In: Cancers" (Basel) 14(5).

# TIMED UP AND DOWN STAIRS TEST (TUDS)

Evaluates specific functional capacities of the physiological systems, namely lower limb strength during ascent (positive work or concentric contraction) and descent (negative work or eccentric contraction). These capacities significantly influence short-duration explosive activities (i.e. anaerobic alactic performance) as well as oxidative metabolism.

## EQUIPMENT

1 Pulse oxymeter.
1 Stopwatch.
1 Stairs of 11 step each 16.5 cm high
1 Evaluation grid.
1 Pen.



## HUMAN RESOURCES

2 Exercise professionals.



TIMED UP AND DOWN STAIRS TEST (TUDS)

## PROTOCOL

The participant may ascend and descend the stairs at either a walking pace or a fast skip pace. Upon reaching the top of the stairs, both feet must be placed on the landing. The participant then turns and descends the stairs. The exercise professional starts the stopwatch when the participant places the first foot on the initial step. The participant is instructed to climb the stairs at her/his own pace, but in the fastest possible time. The stopwatch is stopped when the participant places both feet on the bottom landing. The participant may hold the handrail if needed. The test is repeated three times, with one minute of recovery between trials. The best performance is recorded.

## SAFETY MEASURES

To guarantee maximum safety, 1 exercise professional follows the participant along the stairs.

## OUTCOMES

| SYMBOL | NAME | U.M. |
|---|---|---|
| t | Time | sec |
| HR | Heart rate (beat/min) | bpm |
| $SaO_2$ | Arterial oxygen saturation | % |

Zaino C.A., Marchese V.G., Westcoot S.L. (2004), “Timed up and down stairs test: preliminary reliability and validity of a new measure of functional mobility”, In: Pediatr Phys Ther, 16(2).

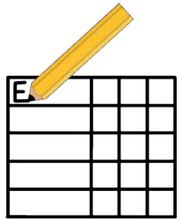
2 EXERCISE TESTING PROTOCOLS / FUNCTIONAL CAPACITY AND PERFORMANCE

# 6-MINUTE WALKING TEST (6MWT)

Is used to evaluate the 6-minute walking distance and measures the functional exercise capacity.

## EQUIPMENT

1 Measuring wheel.
1 Pulse oxymeter.
1 Stopwatch.
1 Corridor of 20 meters.
1 Evaluation grid.
1 Pen.



## HUMAN RESOURCES

1 Exercise professional.



6-MINUTE WALKING TEST (6MWT)

## PROTOCOL

The participant walks (running is not allowed), performing a change of direction every 20 metres using a measuring wheel, for 6 minutes.
The observer provides standardised instructions to the participant as follows: 1) after 1 minute: “you are doing well, you have 5 minutes remaining”; 2) after 2 minutes: “keep going, you have 4 minutes remaining”; 3) after 3 minutes: “you are doing well, you are halfway there”; 4) after 4 minutes: “keep going, you have 2 minutes remaining”; 5) after 5 minutes: “you are doing well, you have 1 minute remaining”.
No additional information or encouragement to increase speed is permitted.

## SAFETY MEASURES

In order to prevent the risk of injury, playground standards requiring soft play surfaces and restricted fall heights are used.

## OUTCOMES

| SYMBOL | NAME | U.M. |
|---|---|---|
| Final distance | Workload | m |
| Final HR | Heart rate (beat/min) | bpm |
| Final $SaO_2$ | Arterial oxygen saturation | % |
| Score | Borg scale | n° |

Zaino C.A., Marchese V.G., Westcoot S.L. (2004), “Timed up and down stairs test: preliminary reliability and validity of a new measure of functional mobility”, In: Pediatr Phys Ther, 16(2).

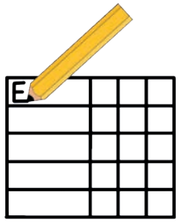
3
EXERCISE TESTING PROTOCOLS / FUNCTIONAL CAPACITY AND PERFORMANCE

# 6-MINUTE CYCLING TEST (A6MCT)

It is used to determine the number of revolutions within 6 minutes on the bicycle ergometer and to assess the participant's endurance capacity.

## EQUIPMENT

1 Bicycle ergometer (no load).
1 Pulse oxymeter.
1 Stopwatch.
1 Evaluation grid.
1 Pen.
BORG Scale for Perceived Exertion.



## HUMAN RESOURCES

2 Exercise professionals.





# 6-MINUTE CYCLING TEST (A6MCT)

## PROTOCOL

Before starting the test, the procedure is demonstrated and the participant is given the opportunity to complete a short familiarisation. A 10 minutes rest period should be observed before the test.
The examiner reads the following standardised instruction to the participant: "You will cycle as fast as possible and maintain this effort for 6 minutes. Try to continue until I tell you that the test has finished. You are allowed to rest, but try to continue for the full 6 minutes."
The examiner should verbally encourage the participant every 15 seconds throughout the exercise to maintain attention and complete the test: 1) "You're doing well! Keep going!", 2) "You're doing well! Keep going!", 3) "You're doing well, only 3 minutes remaining! Keep going!".
During the final 10 seconds of the test, the examiner should provide a countdown.

## SAFETY MEASURES

To guarantee maximum safety, 1 exercise professional stays close to the participant.

## OUTCOMES

| SYMBOL | NAME | U.M. |
|---|---|---|
| Final power | Workload | w |
| Final HR | Heart rate (beat/min) | bpm |
| Final $Sa0_2$ | Arterial oxygen saturation | % |
| Score | Borg scale | n° |

Jansen M., De Jong M., Coes H.M., Eggermont F., Van Alfen N., De Groot I.J.M. (2012), "The assisted 6-minute cycling test to assess endurance in children with a neuromuscular disorder", In: Muscle & nerve 46 (4).

# QUICK MOTOR FUNCTION TEST / RAISING THE TORSO

The participant should try to lift the torso completely off the mat without using the arms.

## EQUIPMENT

1 Pen.
1 Bed.
1 Evaluation grid.

## STARTING POSITION

lies prone with arms by the sides. The examiner may stabilise the participant's legs.

**0.** Initiates no neck extension.
**1.** Initiates neck extension but cannot raise the head from mat.
**2.** Raises head from the mat but torso remains on mat.
**3.** Partially raises head and torso from the mat.
**4.** Completely lifts head and torso from the mat (approx. 45°).

## HUMAN RESOURCES

1 Exercise professional.

## PROTOCOL & OUTCOMES

Assesses the 14-items score and calculates the final score by adding them up.

Carine I van Capelle 1, Van der Beek N A M E, De Vries JM, Van Doorn PA, Duivenvoorden H J, Leshner RT, Hagemans MLC, Van der Ploeg AT (2012): The quick motor function test: a new tool to rate clinical severity and motor function in Pompe patients. In: J Inherit Metab Dis, 35(2).





# QUICK MOTOR FUNCTION TEST / NECK FLEXION

The participant should try to raise the head to 45° or more off the mat.

## STARTING POSITION

Supine position, with head in midline and arms by the sides.

**0.** Initiates no neck flexion.
**1.** Initiates neck flexion (some movement of the head that indicates neck flexion such as lifting or retracting the chin) but does not raise the head.
**2.** Raises head < 45°.
**3.** Raises head to 45° with difficulty.
**4.** Raises head to 45° or more with no difficulty.

## HUMAN RESOURCES

1 Exercise professional.

# QUICK MOTOR FUNCTION TEST / HAND ACROSS MIDLINE

The participant should try to reach the right or left side of the chest/hip with the right or left arm and cross midline.

## STARTING POSITION

Supine position, with head in the midline and arms by the sides. the examiner places the hand at the level of the participant's chest, on the left and right sides of the midline.

**0**. Makes no attempt to reach towards the midline.

**1**. Makes attempt to reach towards the midline.

**2**. Reaches with R/L arm, the hand does not cross the midline.

**3**. Reaches with R/L arm, hand crosses the midline with difficulty (slowly, requiring effort).

**4**. Reaches with R/L arm, hand crosses the midline without difficulty.

## HUMAN RESOURCES

1 Exercise professional.





# QUICK MOTOR FUNCTION TEST / HIP AND KNEE FLEXION

The participant should try to flex the right or left hip and knee through a full range of motion.

## STARTING POSITION

Supine position, with head in the midline, legs extended and arms by the sides.

**0**. Unable to initiate flexion in R/L hip and knee.

**1**. Initiates flexion in R/L hip and knee, but does not move hip more than 10°.

**2**. Flexes R/L hip and knee through partial range of motion(<90°).

**3**. Flexes R/L hip and knee through a full range of motion but with difficulty (slowly, with effort).

**4**. Flexes R/L hip and knee through a full range of motion without difficulty.

## HUMAN RESOURCES

1 Exercise professional.

# QUICK MOTOR FUNCTION TEST / EXTENDING THE LEGS

The participant should try to extend and raise both legs simultaneously.

## STARTING POSITION

Supine position, with head in the midline, legs extended and arms by the sides.

## HUMAN RESOURCES

1 Exercise professional.

**0.** Does not attempt to raise legs.

**1.** Attempts to raise legs but neither leg leaves the mat (tightens abdominal/leg muscles), or raises 1 leg.

**2.** Raises legs from mat but does not extend them, or uses arms.

**3.** With difficulty extends both legs and lifts them from the mat (e.g. very briefly).

**4.** Extends both legs and lifts them from the mat without difficulty.





# QUICK MOTOR FUNCTION TEST / SIT UP

The participant should try to sit up without using the arms.

## STARTING POSITION

Supine position, with head in the midline, legs in comfortable position, arms by the sides or crossed over the chest.

## HUMAN RESOURCES

1 Exercise professional.

**0.** Does not attempt to sit up (or initiate neck flexion).

**1.** Attempts, but does not achieve sit up (even using the arms).

**2.** Does a sit up, but using the arms.

**3.** Does a sit up without using arms but with difficulty.

**4.** Does a sit up without using arms without difficulty (quick and controlled movement).

# QUICK MOTOR FUNCTION TEST / EXTENDING THE ARMS

The participant should try to raise both arms upwards.

## STARTING POSITION

Comfortable sitting position (seated on a chair, not leaning on the back of the chair), arms by the sides or crossed over the chest.

**0**. Does not attempt to raise arms.

**1**. Attempts to raise arms but they do not come above shoulder level.

**2**. Raises both arms above shoulder level but arms do not quite reach 180°.

**3**. Raises both arms along the body and hands touch above the head but with difficulty (arms are not completely stretched).

**4**. Raises both arms along the body and hands touch above the head without difficulty (arms remain extended).

## HUMAN RESOURCES

1 Exercise professional.





# QUICK MOTOR FUNCTION TEST / STANDING UP FROM A CHAIR

The participant should try to stand up from a chair without using the arms.

## STARTING POSITION

Seated in a chair, arms by the sides and not leaning on the back of the chair.

**0**. Makes no attempt to stand up from chair.

**1**. Attempts to stand up from chair but is not able to (even using arms).

**2**. Stands up from chair using arms.

**3**. Stands up from chair without using arms but with difficulty (slowly, with effort, number of attempts are necessary).

**4**. Stands up from chair without using arms without difficulty.

## HUMAN RESOURCES

1 Exercise professional.

# QUICK MOTOR FUNCTION TEST / STANDING UP FROM HALF-KNEE

The participant should try to stand up from a half-knee position without using the arms.

## STARTING POSITION

1. Both knees on the ground.
2. The examined leg is kneeled.

**0**. Makes no attempt to stand, or: non-applicable.

**1**. Attempts to stand up but is not able to (even using arms)

**2**. Stands by means of half-knee position using L/R knee and using arms.

**3**. Stands by means of half-knee position using L/R knee without using arms but with difficulty.

**4**. Stands by means of half-knee position using L/R knee without using arms and without any difficulty.

## HUMAN RESOURCES

1 Exercise professional.






# QUICK MOTOR FUNCTION TEST / SQUATTING

The participant should try to squat without using the arms.

## STARTING POSITION

Standing.

**0**. Does not initiate squat, or: non-applicable.

**1**. Initiates squat but is unable to bend legs to 90° (even using arms or a support).

**2**. Able to squat using arms or holding on.

**3**. Able to squat without using arms, but with difficulty (quickly falls over, cannot easily maintain position).

**4**. Squats with no difficulty without using arms.

## HUMAN RESOURCES

1 Exercise professional.

# QUICK MOTOR FUNCTION TEST / STANDING UP FROM A SQUATTING POSITION

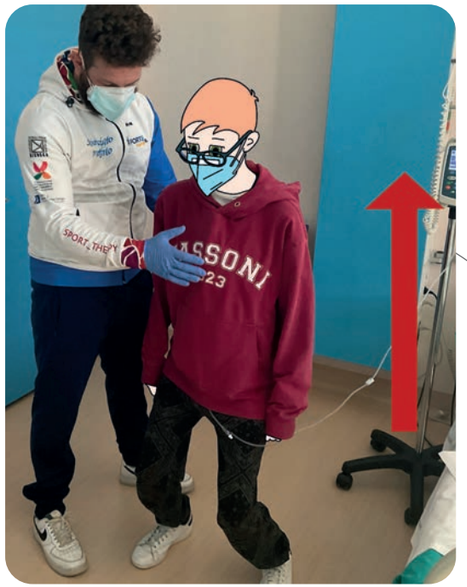
The participant should try to stand up from a squatting position without using the arms.

## STARTING POSITION

Squatting.

## HUMAN RESOURCES

1 Exercise professional.



**0.** Unable to stay in squatting position without help, or: non-applicable.

**1.** Attempts to get up from squatting position but is unable to stand (also not when using arms).

**2.** Able to go from squatting to standing using arms.

**3.** Able to go from squatting to standing without using arms but with difficulty.

**4.** Goes from squatting to standing without using arms with no difficulty.





# QUICK MOTOR FUNCTION TEST / PICKING UP AN OBJECT

The participant should try to pick up an object from the floor and stand up again without arm support.

## STARTING POSITION

Standing without arm support.

## HUMAN RESOURCES

1 Exercise professional.

**0.** Makes no attempt to pick up an object from the floor, or: non-applicable.

**1.** Attempts to pick up an object from the floor, put does not pick up the object.

**2.** Picks up object from the floor and stands up again using arms (uses arms for balance, both on the floor and on the body).

**3.** Able to pick up an object from the floor without arm support and stand up again with difficulty.

**4.** Able to pick up an object from the floor without arm support and stand up again without difficulty (fast, controlled movement).

# QUICK MOTOR FUNCTION TEST / STANDING ON ONE LEG

The participant should try to stand on one leg for 10 seconds without arm support.

## STARTING POSITION

Standing without arm support.

## HUMAN RESOURCES

1 Exercise professional.

**0**. Lifts L/R foot up without arm support, OR: non-applicable.

**1**. Stands without arm support, lift L/R foot up for < 3 seconds.

**2**. Stands without arm support, lifts L/R foot up for 3-9 seconds.

**3**. Stands without arm support, lifts L/R foot up for 10 seconds with difficulty.

**4**. Stands without arm support, lifts L/R foot up for 10 seconds without difficulty.





# QUICK MOTOR FUNCTION TEST / WALKING 10 METERS

The participant should try to walk 10 meters forward without arm support.

## STARTING POSITION

Standing without arm support.

## HUMAN RESOURCES

1 Exercise professional.

**0**. Does not attempt to walk, or: non-applicable.

**1**. Attempts to, but cannot walk for 10 m, even with support (hands, wall).

**2**. Walks 10 m but uses hands or wall for support.

**3**. Walks 10 m without support of hands or wall, but with abnormal gait (e.g. staggering).

**4**. Walks 10 m without difficulty.

# QUICK MOTOR FUNCTION TEST / JUMP

The participant should try to jump forward with both feet simultaneously.

## STARTING POSITION

Standing without arm support.

## HUMAN RESOURCES

1 Exercise professional.

**0**. Does not attempt to jump forwards, OR: non-applicable.

**1**. Jumps forwards < 10 cm with both feet simultaneously (or falls on jumping or landing).

**2**. Jumps forwards between 10 and 40 cm with both feet simultaneously.

**3**. Jumps forwards between 40 and 100 cm with both feet simultaneously.

**4**. Jumps forwards more than 100 cm with both feet simultaneously and without effort.





# QUICK MOTOR FUNCTION TEST / WALKING UP STEPS

The participant should try to  walk up 4 steps using alternating feet without arm support.

## STARTING POSITION

Standing without arm support.

## HUMAN RESOURCES

1 Exercise professional.

**0**. Does not attempt to walk up 4 steps, OR: non-applicable.

**1**. Walks (alternating or non-alternating feet), up 1 or more step using railing.

**2**. Walks (alternating or non-alternating feet), up 4 steps using railing.

**3**. Walks up 4 steps using non-alternating feet without arm support.

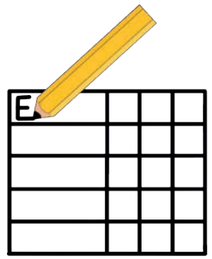
**4**. Walks up 4 steps using alternating feet without arm support.

# SIT-TO-STAND TEST

It is used to evaluate lower limb strength and endurance.

## EQUIPMENT

1 Adjustable bench.
1 Stopwatch.
1 Evaluation grid.
1 Pen.



## HUMAN RESOURCES

1 Exercise professional.

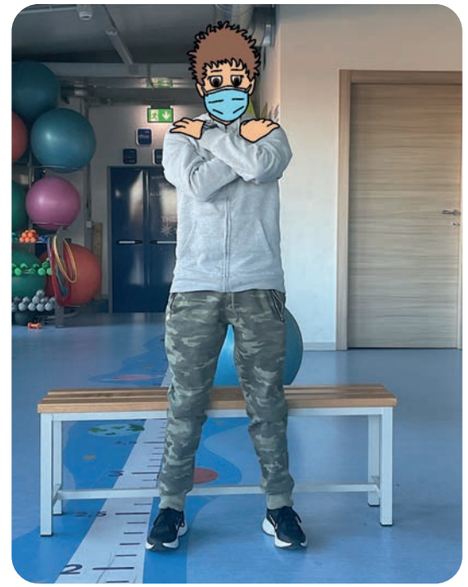




# SIT-TO-STAND TEST

## PROTOCOL

The participant must sit and stand five times on the bench as fast as possible.
The height should be adjusted according to the participant's height.
The exercise is repeated three times with 1 minute of recovery. The average time is recorded.
The average between 3 values is used to record the test.



## SAFETY MEASURES

In case the participant is unable to reach the standing position, the exercise professional helps the participant. An adjustable bench must be used according to the different ages of participants.

## OUTCOMES

| SYMBOL | NAME | U.M. |
|---|---|---|
| t | Time | sec |

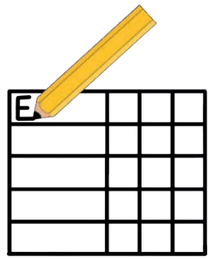
Wang T.H., Liao H.F., Peng Y.C. (2012), "Reliability and validity of the five-repetition sit-to-stand test for children with cerebral palsy", In: Clinical Rehabilitation 26(7).

# STAND/SIT AND REACH TEST

It is used to evaluate the flexibility of the torso and hamstring muscles.

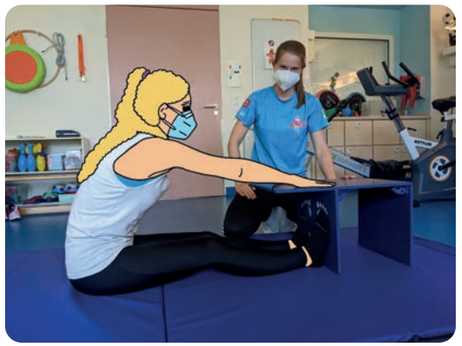
## EQUIPMENT

1 Wooden box with front panel.
1 Graduated scale from +20 to -48 cm.
1 Evaluation grid.
1 Pen.



## HUMAN RESOURCES

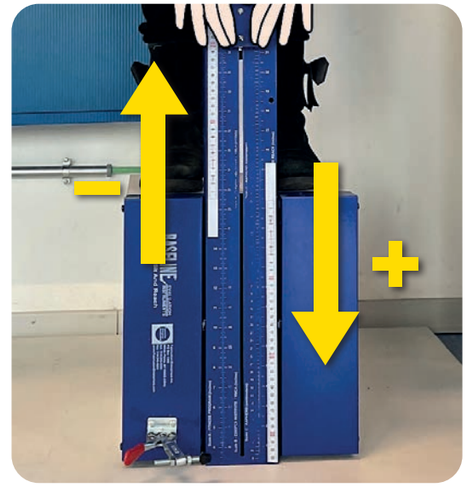
1 Exercise professional.



STAND/SIT AND REACH TEST

## PROTOCOL

The participant, standing with straight legs on a wooden box, slowly bends forward towards the ground.
During the movement, the hands must descend in parallel towards the ground along the graduated scale.
The farthest point reached is held for 2 seconds and recorded.
The test is performed twice; between attempts, the participant is allowed to stand upright for a few seconds. The best value from the two attempts is recorded.
The participant must perform the movement slowly, and the knees must remain fully extended.




## SAFETY MEASURES

An exercise professional must supervise the ascent and descent from the box.

## OUTCOMES

| SYMBOL | NAME | U.M. |
|---|---|---|
| Distance | Flexibility | + cm and - cm |

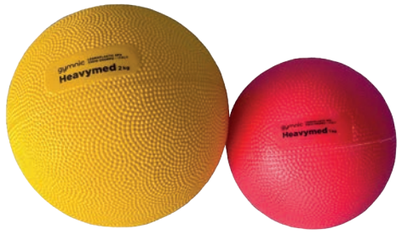
Bös K., Worth A., Opper E., Oberger J., Woll A. (2009), "Motorik-Modul: eine Studie zur Motorische Leistungsfähigkeit und körperlich-sportliche Aktivität von Kindern und Jugendlichen in Deutschland", Ed. Nomos Verlag, Baden-Baden.

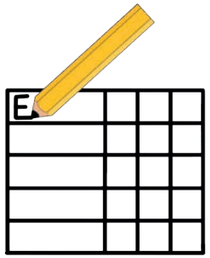
# MEDICINE BALL SHOT TEST

It is used to evaluate upper limb and trunk power.

## EQUIPMENT

1 Medicine balls weighing 1 kg or 2 kg.
1 Launch line marked on floor with. Tape measure.
1 Evaluation grid.
1 Pen.




## HUMAN RESOURCES

1 Exercise professional.




MEDICINE BALL SHOT TEST

## PROTOCOL

The participant positions himself/herself on the launch line, holding the medicine ball (1 kg for ages 6–11, 2 kg for ages 12–18) close to the chest.
With feet parallel and shoulder-width apart, the participant must remain still and attempt to throw the ball as far as possible. Two attempts are allowed.
The result of the test is the farthest distance achieved across the two attempts.

## SAFETY MEASURES

No one must remain in the launch area.

## OUTCOMES

| SYMBOL | NAME | U.M. |
|---|---|---|
| Distance | Workload | m |

Bös K. (2000), "AST 6-11: Allgemeiner sportmotorischer Test für Kinder von 6 bis 11 Jahren", in: Haltung und Bewegung, 20(2).

Beck J., Bös K. (1995), "Normwerte motorischer Leistungsfähigkeit. Eine Reanalyse publizierter Testdaten", in: Sport und Buch Strauss Ed Sport, Köln.

# QUADRICEPS STRENGTH TEST (LEG EXTENSION MACHINE)

It is used to evaluate quadriceps strength using a leg extension machine. The five-repetition maximum method (5RM) is used.

## EQUIPMENT

1 Leg extension machine.
1 Evaluation grid.
1 Pen.

## HUMAN RESOURCES

1 Exercise professional.

| QUADRICEPS STRENGHT by Leg Extention Machine | | | | |
|---|---|---|---|---|
| Attemps | Repetition | Load (kg) | Recovery (sec) | % RM |
| Warm up | 5 | unload | 0 | |
| 1 | | | 60 | 50% |
| 2 | | | 60 | 70% |
| 3 | | | 120 | 90% |
| 4 | | | 120 | 100% |
| 5 | | | stop | 105% |

**BRZYCKI FORMULA**

**1 RM = weight lifted / [1.0278 – (0.0278 x number of repetitions)]**



QUADRICEPS STRENGTH TEST (LEG EXTENSION MACHINE)

## PROTOCOL

For the lower limbs, knee extensor strength is assessed using a leg extension machine adapted to the participant's anthropometric characteristics. The movement starts with the knee flexed at 90°, followed by a bilateral extension of the quadriceps femoris, while keeping the sacrum supported on the seat and the dorsolumbar spine in contact with the backrest.
The protocol consists of performing a five-repetition maximum (5RM) as preparation before estimating the one-repetition maximum (1RM) using the Brzycki formula.
The exercise professional selects the workload increments during the session, starting at approximately 50% of the estimated 1RM. The test is performed for up to three trials, with 1 minute of rest between attempts, progressively increasing the load until the participant completes all repetitions. If the maximal workload is not reached, up to two additional trials are allowed, with 2 minutes of rest between attempts.
The test is considered successful if the participant completes all repetitions without compensatory movements. If the movement is performed incorrectly, the last correctly completed repetition is recorded as the maximal value.
If the participant performs all five attempts incorrectly, the test must be repeated after at least 24 hours of rest. In this case, the test begins at approximately 90% of the estimated 1RM. The value obtained from the five repetitions is then used to calculate the final 1RM according to the Brzycki formula.

## SAFETY MEASURES

Warm up the muscles before the test.
Avoid other lower limb exercises for 24 hours following the 5RM test.

## OUTCOMES

| SYMBOL | NAME | U.M. |
|---|---|---|
| 1RM | One repetition maximum | kg |

Fiuza-Luces C., Padilla J.R., Soares-Miranda L., Lucia A. (2017), "Exercixse Intervention in Pediatric Patients with Solid Tumors: The Physical Activity in Pediatric Cancer Trial", In: Medicine and Science in Sport and Exercise, 49(2).

9
EXERCISE TESTING PROTOCOLS / MUSCLE STRENGTH ASSESSMENT

# BICEPS BRACHII STRENGTH TEST (DUMBBELLS)

It is used to assess biceps brachii strength using a biceps curl test with dumbbells. The five-repetition maximum (5RM) method is used.

## EQUIPMENT

2 Dumbbells of various weights.
1 Stable chair.
1 Evaluation grid.
1 Pen.

## HUMAN RESOURCES

1 Exercise professional.


| BICEPS STRENGHT by dumbbells | | | | |
|---|---|---|---|---|
| Attemps | Repetition | Load (kg) | Recovery (sec) | % RM |
| Warm up | 5 | unload | 0 | |
| 1 | | | 60 | 50% |
| 2 | | | 60 | 70% |
| 3 | | | 120 | 90% |
| 4 | | | 120 | 100% |
| 5 | | | stop | 105% |

**BRZYCKI FORMULA**
**1 RM = weight lifted / [1.0278 – (0.0278 x number of repetitions)]**



BICEPS BRACHII STRENGTH TEST (DUMBBELLS)



## PROTOCOL

For the upper limbs, elbow flexor strength is assessed using a biceps curl test. The movement starts with the elbows at full extension, and the arms are raised until the dumbbells reach shoulder level. The arms are then gradually returned to the starting position.
The protocol consists of performing a five-repetition maximum (5RM) as preparation before estimating the one-repetition maximum (1RM) using the Brzycki formula.
The exercise professional selects the workload increments during the session, starting at approximately 50% of the estimated 1RM. The test is performed for up to three trials, with 1 minute of rest between attempts, progressively increasing the load until the participant completes all repetitions. If the maximal workload is not reached, up to two additional trials are allowed, with 2 minutes of rest between attempts.
Repetitions are only counted if correct form is demonstrated. If the movement is performed incorrectly, the last correctly completed repetition is recorded as the maximal value.
If the participant performs all five attempts incorrectly, the test must be repeated after at least 24 hours of rest. In this case, the test begins at approximately 90% of the estimated 1RM. The value obtained from the five repetitions is then used to calculate the final 1RM according to the Brzycki formula.

## SAFETY MEASURES

Warm up the muscles before the test.
Avoid other upper limb exercises for 24 hours following the 5RM test.

## OUTCOMES

| SYMBOL | NAME | U.M. |
|---|---|---|
| 1RM | One repetition maximum | kg |

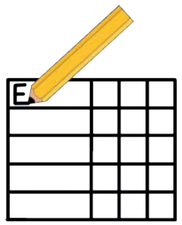
Fiuza-Luces C., Padilla J.R., Soares-Miranda L., Lucia A. (2017), "Exercixse Intervention in Pediatric Patients with Solid Tumors: The Physical Activity in Pediatric Cancer Trial", In: Medicine and Science in Sport and Exercise, 49(2).

# QUADRICEPS AND HAMSTRINGS STRENGHT TEST (HANDHELD DYNAMOMETER)

It is used to measure quadriceps and hamstring strength using a handheld dynamometer (CITEC).

## EQUIPMENT

1 Handheld dynamometer.
1 Evaluation grid.
1 Pen.
1 Gym mat.




## HUMAN RESOURCES

1 Exercise professional.

LEG EXTENSION

LEG CURL



QUADRICEPS AND HAMSTRINGS STRENGHT TEST (HANDHELD DYNAMOMETER)



## PROTOCOL

The criteria for performing the knee flexor and extensor assessments are shown below:

| **Evaluation of knee flexors** | |
|---|---|
| Position of study participant | Prone, knee flexed 45° |
| Position of dynamometer | Heel |
| Position of exercise professional | Standing on right side of the partecipant |

| **Evaluation of knee extensor** | |
|---|---|
| Position of study participant | Prone, knee flexed 90° |
| Position of dynamometer | Anterior distal surface of tibia |
| Position of exercise professional | Standing on right side of the partecipant |

The break test protocol is used for this measurement. The exercise professional gradually overcomes the force of the study participant, who attempts to flex or extend the leg to maximal effort and resists until the point of voluntary release. The device automatically records the highest value, which is then used for analysis. As this is an eccentric contraction, the movement must be performed at a slow speed.
Three measurements are performed for both knee flexors and knee extensors, and the highest value is recorded.

## SAFETY MEASURES

Warm up the muscles before the test. An exercise professional must supervise the ascent and descent.

## OUTCOMES

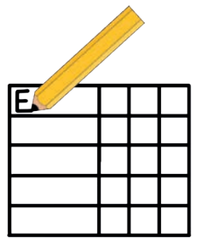
| NAME | U.M. |
|---|---|
| Knee flexor strength – dominant leg | N |
| Knee extensor strength – dominant leg | N |

# BICEPS BRACHII STRENGHT TEST (HANDHELD DYNAMOMETER)

It is used to measure biceps brachii strength using a handheld dynamometer (CITEC).

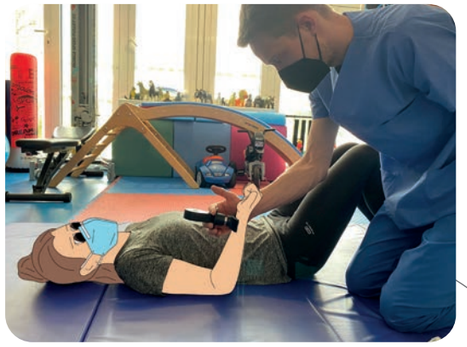
## EQUIPMENT

1 Handheld dynamometer.
1 Evaluation grid.
1 Pen.
1 Gym mat.




## HUMAN RESOURCES

1 Exercise professional.





BICEPS BRACHII STRENGHT TEST (HANDHELD DYNAMOMETER)

## PROTOCOL

The criteria for performing the knee flexor and extensor assessments are shown below:

| **Evaluation of elbow flexors (biceps)** | |
|---|---|
| Position of study participant | Supine, shoulder adducted, elbow 90° flexed, forearm supinated |
| Position of dynamometer | Just proximal to wrist crease (flexor surface) |
| Position of exercise professional | Standing next to partecipant |
| Fixation | Partecipant grasps edge of examination couch with opposite hand |

The participant must lie flat with at most one cushion; otherwise, the standard position will be interfered with. There is a tendency to move the shoulder up and forward, elongating the biarticular biceps muscle. In particular, male elbow flexors can be very strong. Above 200 N (stronger participants), it is recommended to perform the test on a mat on the floor. It is impossible to measure both elbow flexors from one side.
Three measurements are performed for both elbow flexors, and the highest value is recorded.

## SAFETY MEASURES

Warm up the muscles before the test. An exercise professional must supervise the ascent.

## OUTCOMES

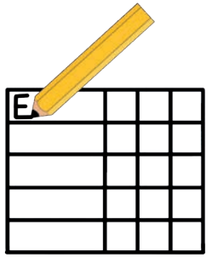
| NAME | U.M. |
|---|---|
| Elbow flexor strength – dominant arm | N |

# HANDGRIP STRENGTH TEST

It is used to assess hand strength using a dynamometer.

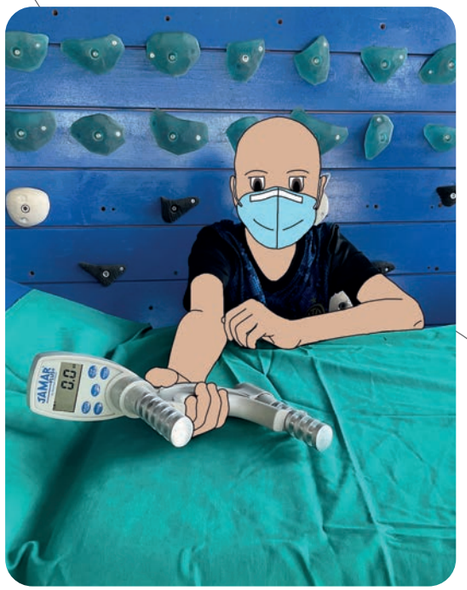
## EQUIPMENT

1 Hand grip.
1 Table.
1 Adjustable bench.
1 Evaluation grid.
1 Pen.



## HUMAN RESOURCES

1 Exercise professional.





HANDGRIP STRENGTH TEST

## PROTOCOL

While seated and with the elbow flexed, the participant should squeeze the hand dynamometer as tightly as possible.
Three measurements are performed for each hand, and the average value is recorded, alternating hand between trials with a 60 seconds rest between measurements on the same hand.

## SAFETY MEASURES

Use a examination couch to perform the test.

## OUTCOMES

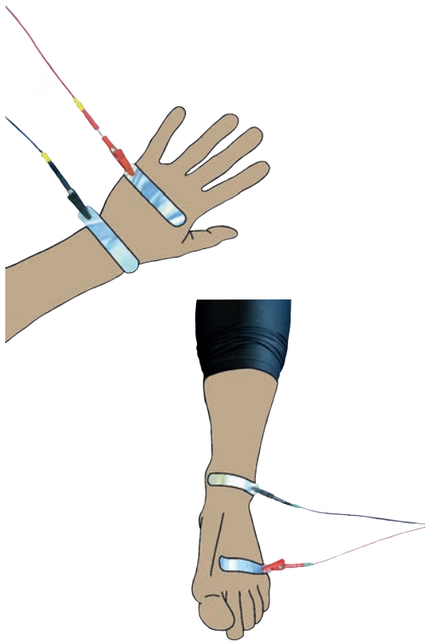
| NAME | U.M. |
|---|---|
| Strenght of left hand | kg |
| Strenght of right hand | kg |

# BIOELECTRICAL IMPEDANCE ANALYSIS (BIA)

In BIA, a phase-sensitive impedance analyser is used to apply a sinusoidal alternating current at different frequencies (5 kHz, 50 kHz and 100 kHz) to specific body segments of the study participant. The fluid content of different body compartments is measured, as well as hydration status.

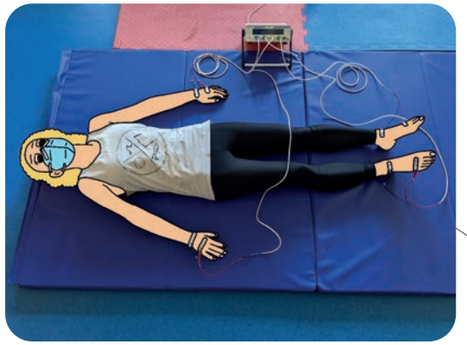
## EQUIPMENT

1 Gym mat.
4 Electrodes.



## HUMAN RESOURCES

1 Exercise professional.





BIOELECTRICAL IMPEDANCE ANALYSIS (BIA)



## PROTOCOL

BIA is a safe, inexpensive and widely used method for assessing muscle loss (cachexia), changes in cell mass and hydration status. In the FORTEe study, the BIACorpus RX4004M device is used for this purpose.
Prior to the BIA measurement, the participant's weight, height, and waist and hip circumferences (waist-to-hip ratio) are measured. The participant must then lie supine for 3–5 minutes before the measurement begins.
The measuring electrodes (two per limb; eight in total) are applied to the dorsal surfaces of both hands and feet. The measurement takes 30–90 seconds. During this process, the following raw data are collected for the corresponding body segments:

| Body segment | Frequency |
|---|---|
| Rught Side | 5 kHz, 50 KHz, 100 KHz |
| Arms/Upper Body | 50 KHz |
| Legs/Upper Body | 50 KHz |
| Left Side | 5 KHz |

## SAFETY MEASURES

The participant should remain supine throughout the test.

## OUTCOMES

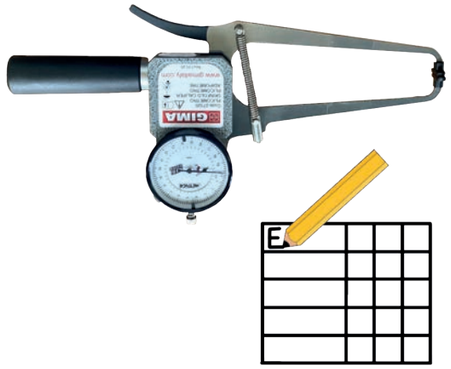
| NAME | U.M. |
|---|---|
| Reactance | Ω |
| Impedance | Ω |
| Phase angle | ° |

# BODY COMPOSITION ASSESSMENT BY SKINFOLDS (PLICOMETRY)

It is used to estimate body fat percentage by measuring skinfold thickness.

## EQUIPMENT

1 Plicometer.
1 Pen.
1 Evaluation grid.



## HUMAN RESOURCES

1 Exercise professional.

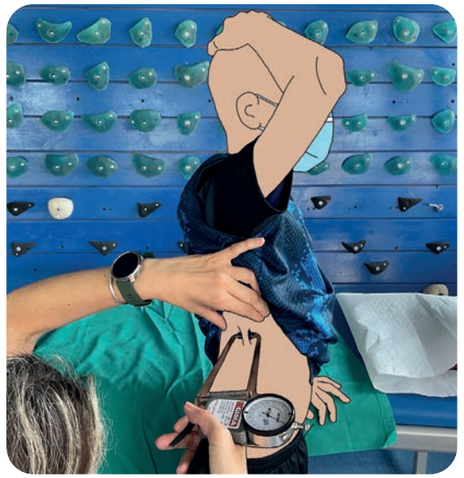
TRICEPS SKINFOLD:
on the midline of the posterior surface of the arm.

BICEPS SKINFOLD:
on the midline of the anterior surface of the arm.



BODY COMPOSITION ASSESSMENT BY SKINFOLDS (PLICOMETRY)

SUBSCAPULAR SKINFOLD:
at the inferior angle of the scapula.



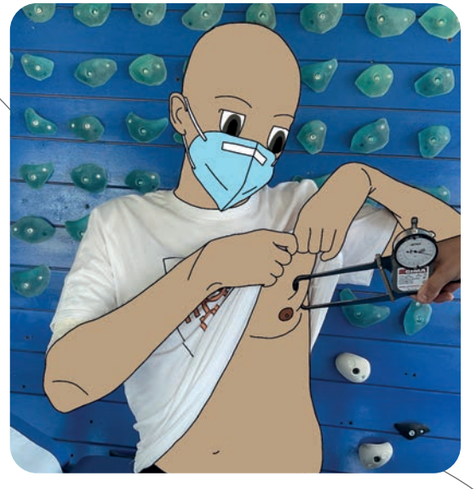
MIDAXILLARY SKINFOLD:
at the midaxillary line, at the level of the lowest point of the sternum.

THIGH SKINFOLD:
on the thigh, midway between the patella and the inguinal fold.

SUPRAILIAC SKINFOLD:
on the top of the iliac crest.

# BODY COMPOSITION ASSESSMENT BY SKINFOLDS (PLICOMETRY)

ABDOMINAL SKINFOLD:
5 cm lateral to the umbilicus.



CHEST SKINFOLD (JUST FOR MEN):
at the midpoint between the axilla and the nipple.



BODY COMPOSITION ASSESSMENT BY SKINFOLDS (PLICOMETRY)

## PROTOCOL

For men, the thickness of the subcutaneous fat layer is measured at seven skinfold sites: triceps, biceps, subscapular, midaxillary, thigh, suprailiac, abdominal and chest. The Jackson and Pollock equation is used to estimate body fat in men.
For women, the thickness of the subcutaneous fat layer is measured at six skinfold sites: triceps, biceps, subscapular, midaxillary, thigh, suprailiac and abdominal. The Katch equation is used to estimate body fat in women.
Each site will be measured three times and averaged. The final value is recorded.

## SAFETY MEASURES

The participant should stay near the medical bed.

## OUTCOMES

| NAME | U.M. |
|---|---|
| Skinfold | mm and percentile |

McArdle WD, Katch FI, Katch VL (2010): Exercise Physiology: Nutrition, Energy and Human Performance.

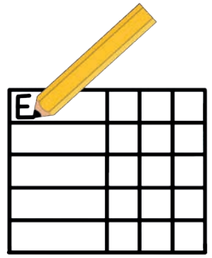
15
EXERCISE TESTING PROTOCOLS / ANTHROPOMETRY AND BODY COMPOSITION

# MID-UPPER ARM CIRCUMFERENCE MEASUREMENT

It is used to evaluate the nutritional status.

## EQUIPMENT

1 Meter.
1 Pen.
1 Evaluation grid.



## HUMAN RESOURCES

1 Exercise professional.



MID-UPPER ARM CIRCUMFERENCE MEASUREMENT

## PROTOCOL

This girth is measured with the arm relaxed and hanging by the side. The circumference is taken at the midpoint between the acromion and the olecranon processes.
For this purpose, the mean of three measurements is calculated and recorded in centimetres.

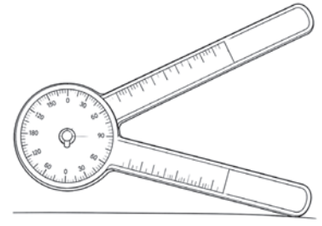
## SAFETY MEASURES

The participant should stay near the examination couch.

## OUTCOMES

| SYMBOL | NAME | U.M. |
|---|---|---|
| Circumference | | cm |

# JOINT'S RANGE OF MOTION

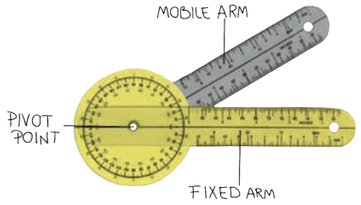


# HIP EXTENSION AND FLEXION

## MOVEMENT

HIP EXTENSION AND FLEXION (ROM 0° - 120°)

## POSITIONING




**FIXED ARM**
Parallel to the midaxillary line of the trunk.

**STARTING POSITION**
The participant is supine, with the hip and knee in a neutral position.

**MOBILE ARM**
Parallel to the longitudinal axis of the femur, directed towards the lateral epicondyle.

**STABILIZATION**
The trunk is stabilised by body weight.

**ACTION**
The hip is flexed to the limit of the movement with simultaneous knee flexion; the pelvis remains in contact with the mat.

**PIVOT POINT**
Positioned over the greater trochanter of the femur.

**MOJOS**
Lumbar spine flexion.



HIP EXTENSION AND FLEXION

HIP EXTENSION

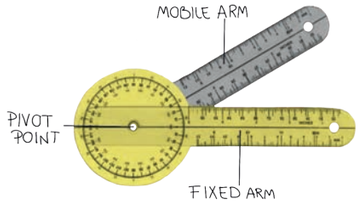
HIP FLEXION

# HIP EXTERNAL AND INTERNAL ROTATION

## MOVEMENT

HIP EXTERNAL AND INTERNAL ROTATION (ROM 0° - 45°)

## POSITIONING




**FIXED ARM**
Perpendicular to the floor.

↓

**STARTING POSITION**
The participant is seated; the hip is flexed to 90° and in neutral rotation; the knee is flexed to 90°; the contralateral hip is abducted (away from the centre of the body), with the foot resting on a stool.

↓

**STABILIZATION**
Stabilise the distal end of the thigh.

↓

**PIVOT POINT**
Positioned at the centre of the patella.

**MOBILE ARM**
Parallel to the anterior midline of the tibia.

↓

**ACTION**
EXTERNAL ROTATION:
The hip is externally rotated to the limit of movement (45°), so that the leg and foot move medially.

INTERNAL ROTATION:
The hip is internally rotated to the limit of movement (45°), so that the leg and foot move laterally.



HIP EXTERNAL AND INTERNAL ROTATION

STARTING POSITION

HIP EXTERNAL ROTATION

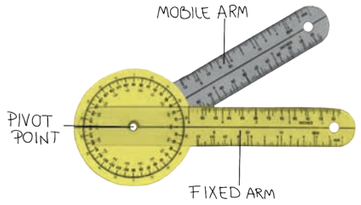
HIP INTERNAL ROTATION

# KNEE EXTENSION AND FLEXION

## MOVEMENT

KNEE EXTENSION AND FLEXION (ROM 0° - 135°)

## POSITIONING




**FIXED ARM**
Parallel to the longitudinal axis of the femur, directed towards the greater trochanter.

↓

**STARTING POSITION**
The participant is supine; the hip is in anatomical position; the knee is extended to 0°.

↓

**STABILIZATION**
The pelvis is stabilised by body weight.

↓

**PIVOT POINT**
Located at the lateral femoral epicondyle.

**MOBILE ARM**
Parallel to the longitudinal axis of the fibula, directed towards the lateral malleolus.

↓

**ACTION**
From the starting position with the knee extended, the hip and knee are flexed; the heel is moved towards the gluteus to the limit of the flexion (135°).

↓

**HYPEREXTENSION**
The femur is stabilised; the leg is moved beyond 0° of extension; hyperextension of up to 10° may be present.



# KNEE HIP EXTENSION AND FLEXION

KNEE EXTENSION

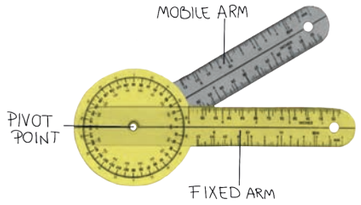
KNEE FLEXION

# KNEE EXTERNAL AND INTERNAL ROTATION

## MOVEMENT

KNEE EXTERNAL AND INTERNAL ROTATION (ROM 0° - 33°)

## POSITIONING




**STARTING POSITION**
The participant is seated; the leg extends over the edge of the couch; the knee is flexed to 90°; the tibia is in full internal rotation.

↓

**STABILIZATION**
Place a shim under the popliteus; the exercise professional stabilises the femur.

↓

**PIVOT POINT**
Located at the center of the heel.

**FIXED ARM**
Along the lateral plantar fascia.

↓

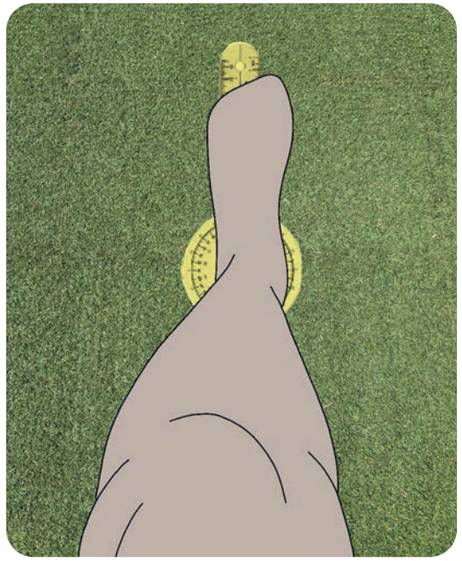
**MOBILE ARM**
Follows tibial excursion.

↓

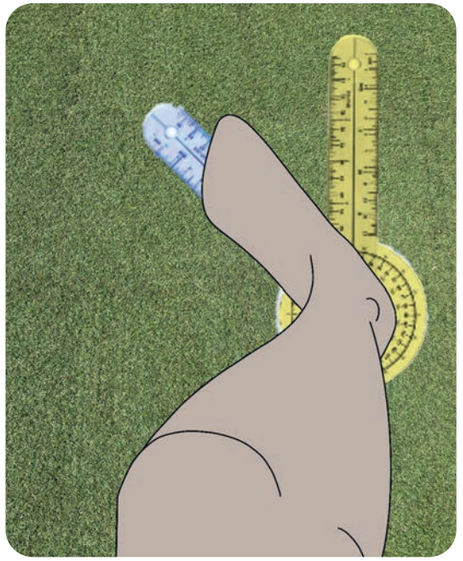
**ACTION**
The tibia is externally and internally rotated; the total range of rotation is recorded (approx. 33°).



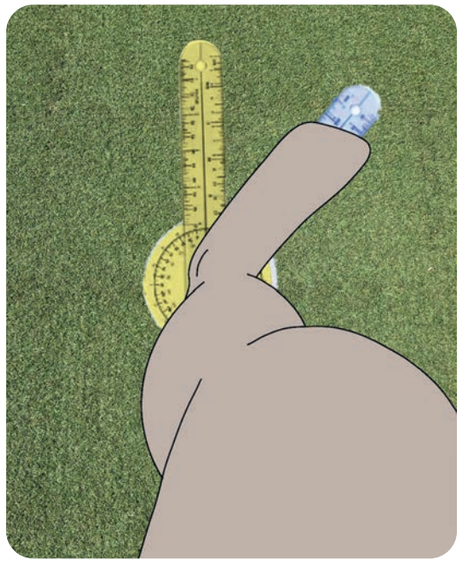
KNEE EXTERNAL AND INTERNAL ROTATION



STARTING POSITION



KNEE EXTERNAL ROTATION



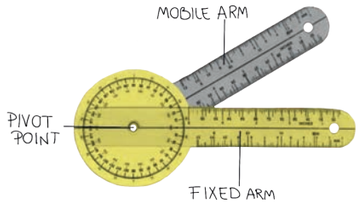
KNEE INTERNAL ROTATION

# ANKLE DORSIFLEXION AND PLANTARFLEXION

## MOVEMENT

ANKLE DORSIFLEXION (ROM 0° - 20°)
AND PLANTARFLEXION (ROM 0° - 50°)

## POSITIONING




**FIXED ARM**
Parallel to the longitudinal axis of the fibula.

↓

**STARTING POSITION**
The participant is seated or in a supine position; the knee is flexed to 90° when seated; the knee is at 30° in the supine position with a rolled-up towel under it; the foot is perpendicular to the leg.

↓

**STABILIZATION**
The exercise professional stabilises the leg.

↓

**PIVOT POINT**
Positioned approximately 1.5 cm below the lateral malleolus.

**MOBILE ARM**
Parallel to the longitudinal axis of the fifth metatarsal.

↓

**ACTION**
DORSIFLECTION: the ankle is dorsiflexed, with the dorsal side of the foot approaching the tibia (20°)
PLANTAR FLEXION: the toe is extended downwards to the limit of movement (50°)



ANKLE DORSIFLEXION AND PLANTARFLEXION


STARTING POSITION


ANKLE DORSIFLEXION

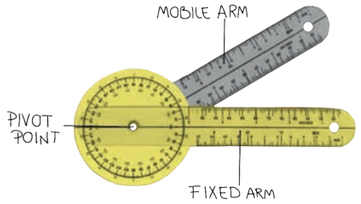

PLANTARFLEXION

# SHOULDER FLEXION

## MOVEMENT

SHOULDER FLEXION (ROM 0° - 180°)

## POSITIONING




**STARTING POSITION**
The participant is supine or seated; the arms are positioned at the sides with the palms touching the hips.

↓

**PIVOT POINT**
Located laterally at the centre of the head of the humerus, approximately 2.5 cm below the acromial process.

↓

**FIXED ARM**
Parallel to the lateral midline of the trunk.

**MOBILE ARM**
Parallel to the longitudinal axis of the humerus, directed towards the lateral epicondyle.

↓

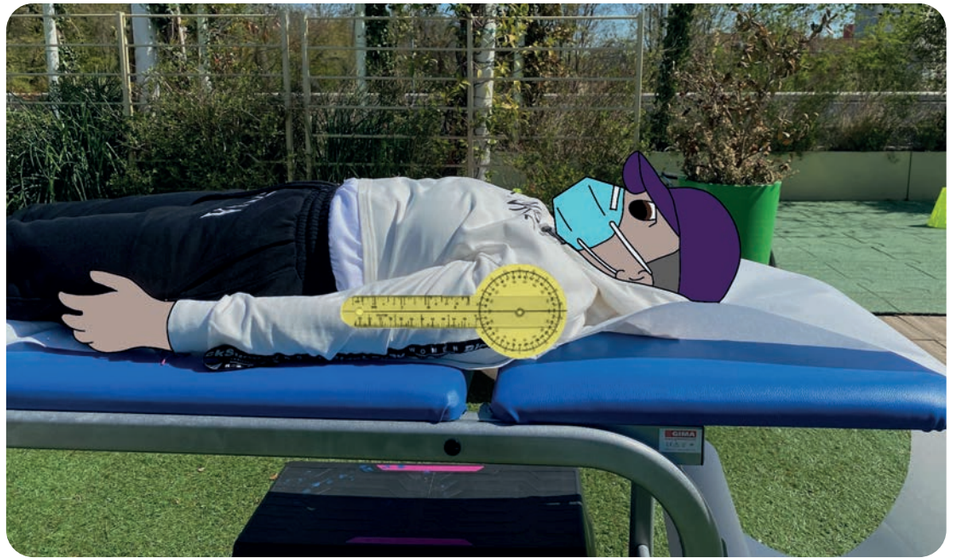
**ACTION**
The humerus moves in an anterior direction to a position behind the ear (180°).

↓

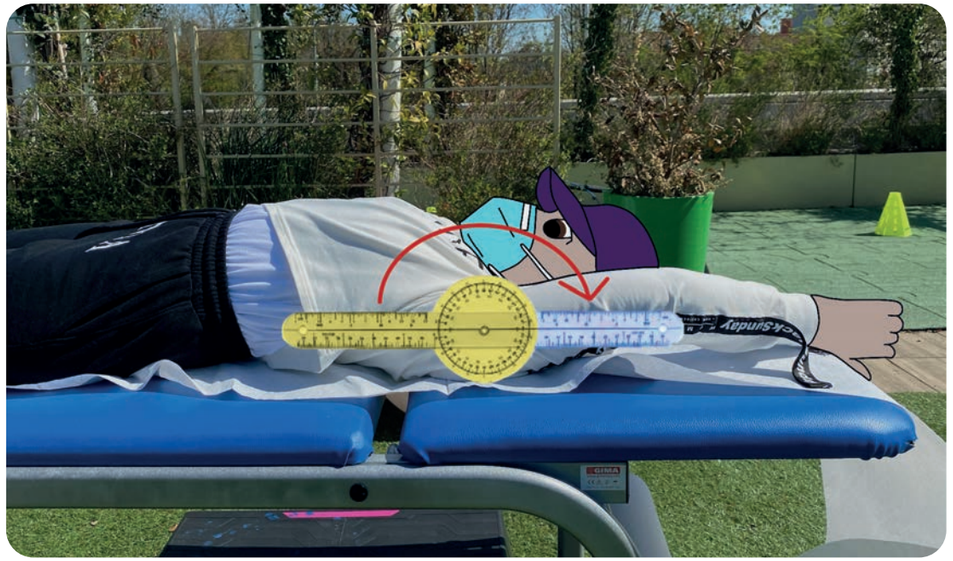
**MOJOS**
From a seated position: trunk extension and shoulder extension.



SHOULDER FLEXION



STARTING POSITION



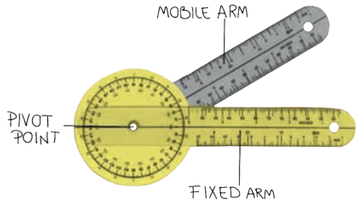
FLEXION

# SHOULDER EXTENSION

## MOVEMENT

SHOULDER EXTENSION (ROM 0° - 60°)

## POSITIONING




**STARTING POSITION**
The participant is seated or supported, with the arms along the sides and the palms facing medially along the midline of the body.

↓

**PIVOT POINT**
It is located laterally at the centre of the head of the humerus, approximately 2.5 cm below the acromial process.

↓

**FIXED ARM**
Parallel to the lateral midline of the trunk.

**MOBILE ARM**
Parallel to the longitudinal axis of the humerus, directed towards the lateral epicondyle.

↓

**ACTION**
The humerus moves posteriorly to the limit of movement (60°).

↓

**MOJOS**
Forward tilt of the scapula, elevation and abduction of the shoulder; the participant may flex the trunk and bend the elbow when sitting.



SHOULDER EXTENSION

STARTING POSITION

EXTENSION

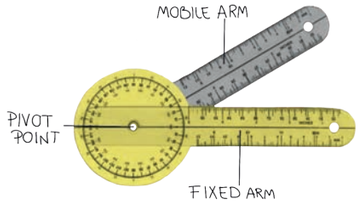
23
JOINT'S RANGE OF MOTION / UPPER LIMB (SHOULDERS, ELBOWS AND WRISTS)

# SHOULDER ABDUCTION

## MOVEMENT

SHOULDER ABDUCTION (ROM 0° - 180°)

## POSITIONING




**STARTING POSITION**
The participant is supine or seated; the arm is along the side in adduction and external rotation.

↓

**PIVOT POINT**
It is located at the centre of the glenohumeral joint, approximately 1.3 cm below the coracoid process.

↓

**FIXED ARM**
Parallel to the sternum.

**MOBILE ARM**
Parallel to the longitudinal axis of the humerus.

↓

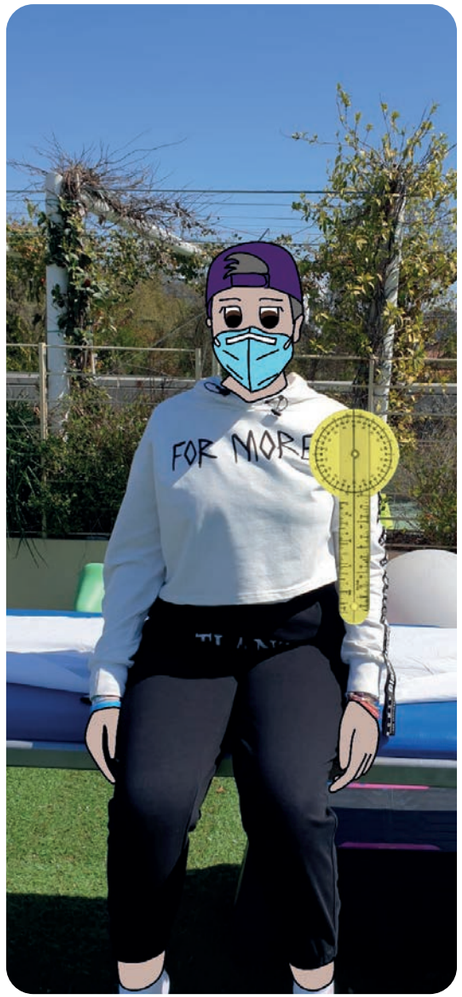
**ACTION**
The humerus moved laterally to the limit of the elevation movement (approx. 180°).

↓

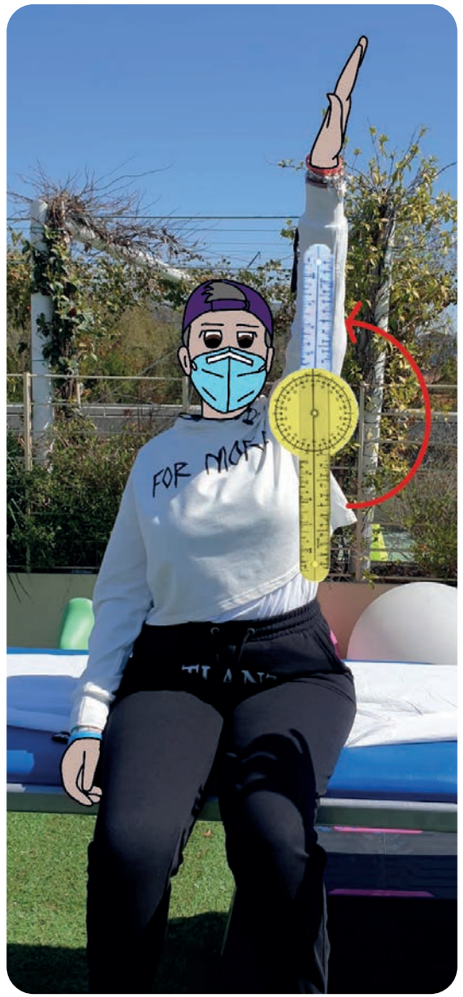
**MOJOS**
Contralateral trunk flexion and scapular elevation.



SHOULDER ABDUCTION



STARTING POSITION



ABDUCTION

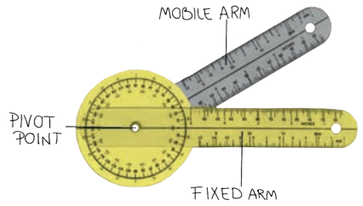
24
JOINT'S RANGE OF MOTION / UPPER LIMB (SHOULDERS, ELBOWS AND WRISTS)

# SHOULDER FLEXION AND EXTENSION IN THE HORIZONTAL PLANE

## MOVEMENT

SHOULDER FLEXION (ROM 0° - 45°) AND EXTENSION (ROM 0° - 135°) IN THE HORIZONTAL PLANE

## POSITIONING




**FIXED ARM**
Perpendicular to the trunk.

↓

**STARTING POSITION**
The participant is seated; shoulder abducted to 90° and in neutral rotation; elbow flexed and forearm in a neutral position.

↓

**STABILIZATION**
The exercise professional supports the abducted arm.

↓

**PIVOT POINT**
Positioned on the vertex of the acromial process.

**MOBILE ARM**
Parallel to the longitudinal axis of the humerus.

↓

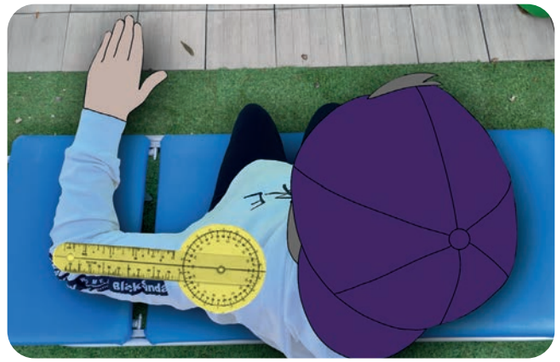
**ACTION**
FLEXION: the humerus moves in an anterior direction, crossing the thorax, to the limit of movement (45°).
EXTENSION: the humerus moves posteriorly to the limit of movement (45°).

↓

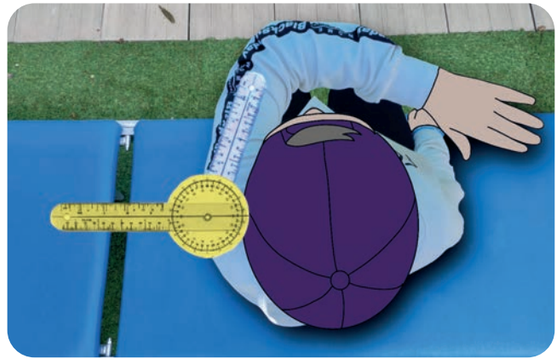
**MOJOS**
FLEXION: contralateral trunk rotation.
EXTENSION: ipsilateral trunk rotation.



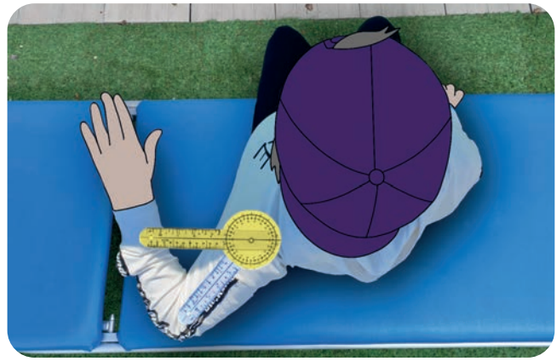
SHOULDER FLEXION AND EXTENSION IN THE HORIZONTAL PLANE



STARTING POSITION



FLEXION



EXTENSION

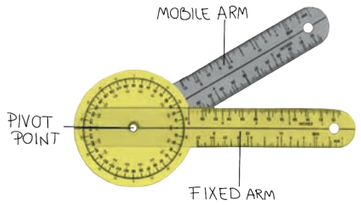
25
JOINT'S RANGE OF MOTION / UPPER LIMB (SHOULDERS, ELBOWS AND WRISTS)

# SHOULDER EXTERNAL ROTATION

## MOVEMENT

SHOULDER EXTERNAL ROTATION (ROM 0° - 110°)

## POSITIONING




**STARTING POSITION**
The participant is seated; shoulder in 90° abduction; elbow flexed 90°; forearm in a neutral position. Place a cloth under the humerus to maintain abduction.

↓

**PIVOT POINT**
Located on the olecranon of the ulna.

↓

**FIXED ARM**
Perpendicular to the trunk.

**MOBILE ARM**
Parallel to the longitudinal axis of the ulna, directed towards the ulnar styloid process.

↓

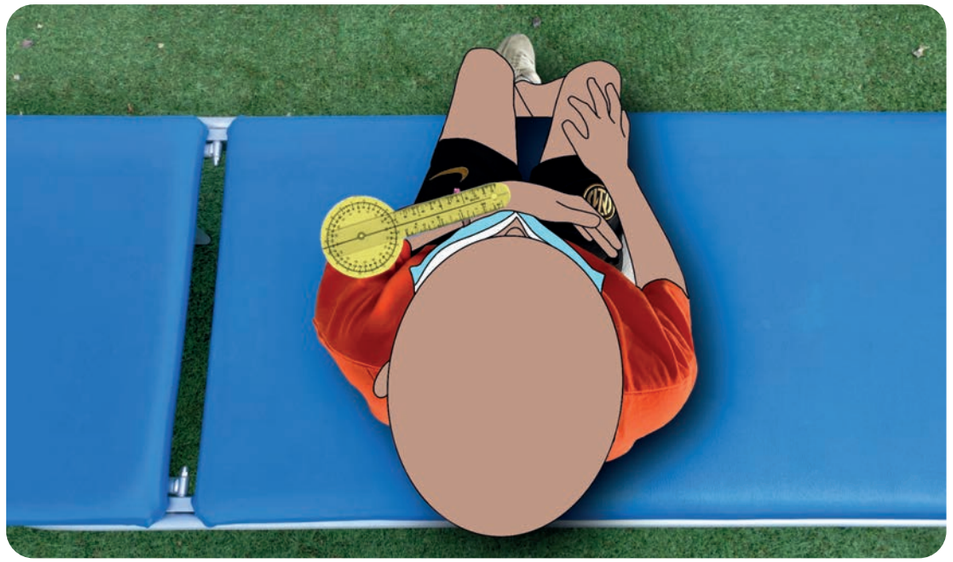
**ACTION**
The back of the hand moves in a lateral and posterior direction to the limit of movement in external rotation (around 110°).

↓

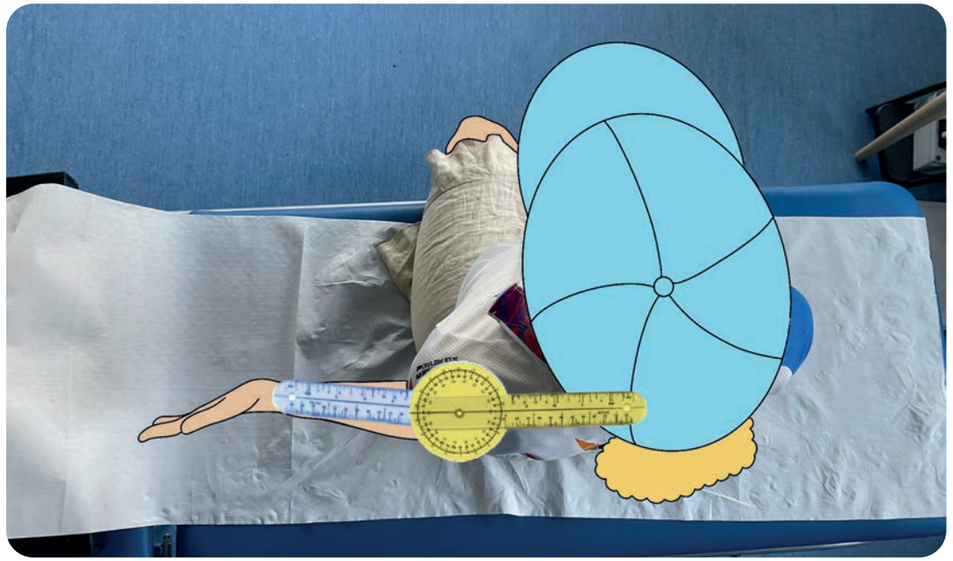
**MOJOS**
Shoulder depression and adduction.



SHOULDER EXTERNAL ROTATION



STARTING POSITION



EXTERNAL ROTATION

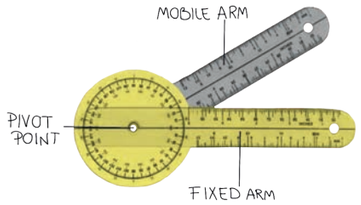
26
JOINT'S RANGE OF MOTION / UPPER LIMB (SHOULDERS, ELBOWS AND WRISTS)

# SHOULDER INTERNAL ROTATION

## MOVEMENT

SHOULDER INTERNAL ROTATION (ROM 0° - 10°)

## POSITIONING




**STARTING POSITION**
The participant is seated; shoulder in 90° abduction; elbow flexed 90°; forearm in a neutral position. Place a cloth under the humerus to maintain abduction.

↓

**PIVOT POINT**
Located on the olecranon of the ulna.

↓

**FIXED ARM**
Perpendicular to the trunk.

**MOBILE ARM**
Parallel to the longitudinal axis of the ulna, towards the ulnar styloid process.

↓

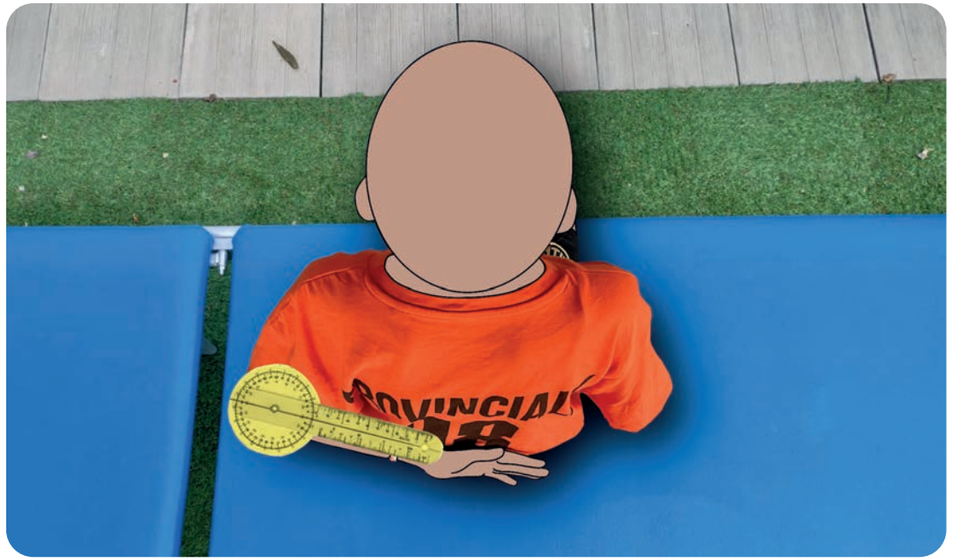
**ACTION**
The palm of the hand moves towards the navel.

↓

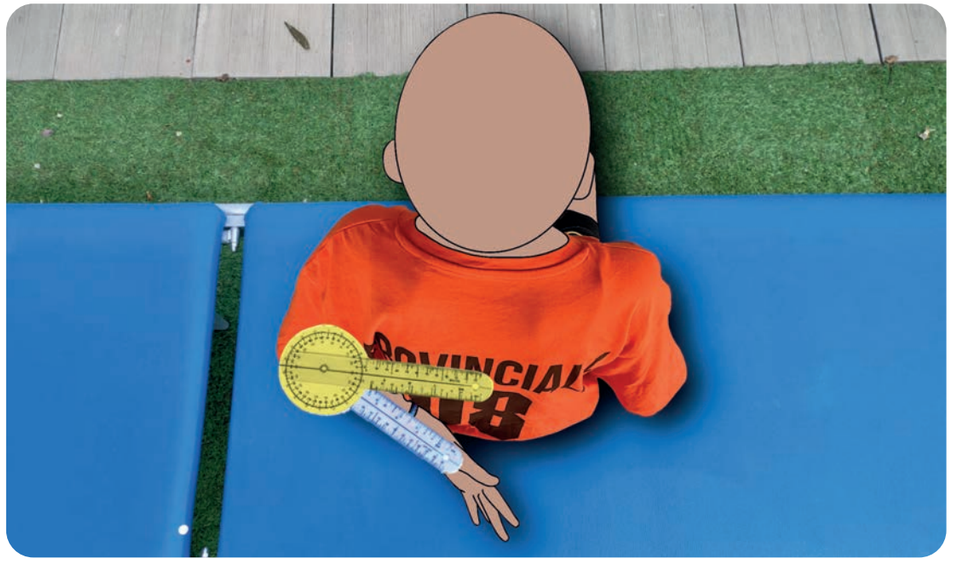
**MOJOS**
Scapular elevation and abduction.



SHOULDER INTERNAL ROTATION



STARTING POSITION



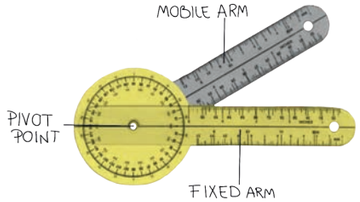
INTERNAL ROTATION

# ELBOW EXTENSION AND FLEXION

## MOVEMENT

ELBOW EXTENSION AND FLEXION (ROM 0° - 150°)

## POSITIONING




**MOBILE ARM**
Parallel to the longitudinal axis of the radius.

**STARTING POSITION**
The participant is supine; the arm is extended at the elbow (0°); the palm is facing upwards.

**STABILIZATION**
The exercise professional stabilises the arm.

**PIVOT POINT**
Positioned at the lateral epicondyle of the humerus.

**FIXED ARM**
Parallel to the longitudinal axis of the humerus.

**ACTION**
From the starting position, the forearm moves in the anterior direction and the hand approaches the shoulder until the limit of elbow flexion (150°) is reached.

**HYPEREXTENSION**
The forearm moves in a posterior direction beyond 0° of extension, a hyperextension of 10° to 15° may be observed.

**MOJOS**
Scapular elevation and abduction.



ELBOW EXTENSION AND FLEXION

EXTENSION

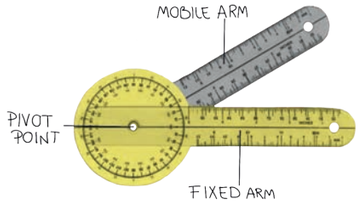
FLEXION

# FOREARM PRONATION AND SUPINATION

## MOVEMENT

FOREARM PRONATION AND SUPINATION (ROM 0° - 80°/90°)

## POSITIONING




**FIXED ARM**
Perpendicular to the floor.

↓

**STARTING POSITION**
The participant is seated; shoulder flexed; elbow at 90°; forearm in a neutral position. The participant holds a pencil in the hand.

↓

**STABILIZATION**
The exercise professional stabilises the humerus.

↓

**PIVOT POINT**
Positioned on the head of the third metacarpal.

**MOBILE ARM**
Parallel to the pencil.

↓

**ACTION**
PRONATION: the forearm rotated internally; the palm faces downwards.
SUPINATION: the forearm rotated outwards; the palm faces upwards.

↓

**MOJOS**
PRONATION: wrist flexion, shoulder adduction, and internal rotation.
SUPINATION: wrist extension, shoulder adduction, and external rotation.



FOREARM PRONATION AND SUPINATION

STARTING POSITION

PRONATION

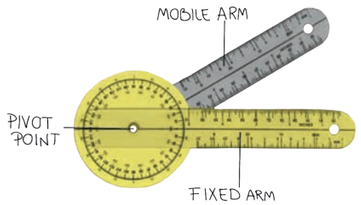
SUPINATION

# WRIST DORSIFLEXION AND PALMARFLEXION

## MOVEMENT

WRIST DORSIFLEXION (ROM 0° - 80°)
AND PALMARFLEXION (ROM 0° - 70°)

## POSITIONING




**FIXED ARM**
Parallel to the longitudinal axis of the ulna.

**STARTING POSITION**
The participant is supine; the shoulder is flexed; the elbow is at 90°; the forearm is in a neutral position.

**STABILIZATION**
The exercise professional stabilises the forearm.

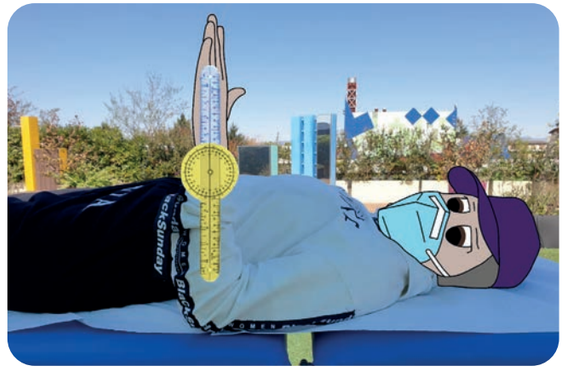
**PIVOT POINT**
Positioned on the head of the third metacarpal.

**MOBILE ARM**
Parallel to the longitudinal axis of the fifth metacarpal.

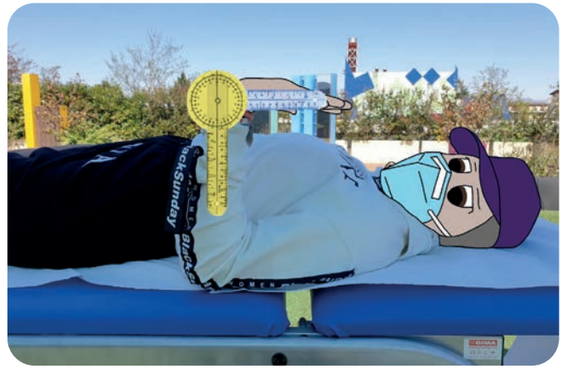
**MOJOS**
DORSI: the wrist moved in a dorsal direction to the limit of movement (70°).
PALMAR: the wrist moved in a palmar direction to the limit of movement (80°).



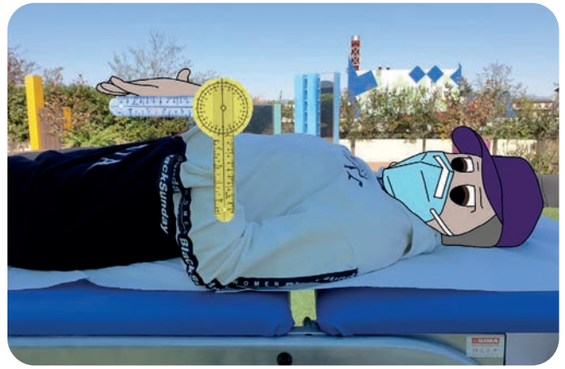
WRIST DORSIFLEXION AND PALMARFLEXION



STARTING POSITION



DORSIFLEXION



PALMARFLEXION

# PLUMB LINE

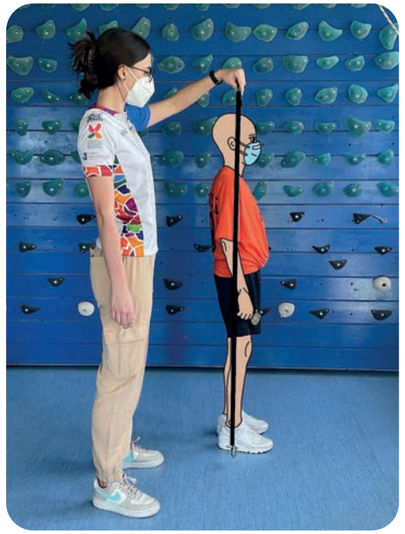
## PROCEDURE

### EQUIPMENT

1 Plumb line.

### IDEAL POSTURAL ALIGNMENT

In ideal postural alignment, the plumb line passes through the balls of the feet. The pelvis is in a neutral position. The lumbar and cervical curves are in physiological lordosis (anterior convexity). The head is in a neutral position without anterior or posterior tilt.
The bony prominences at the front of the pelvis are in a neutral alignment, with the anterior superior iliac spines and the pubic symphysis lying in the same vertical plane.

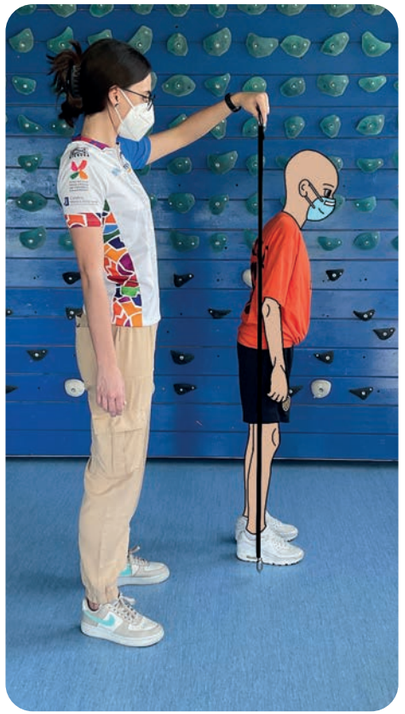




PLUMB LINE

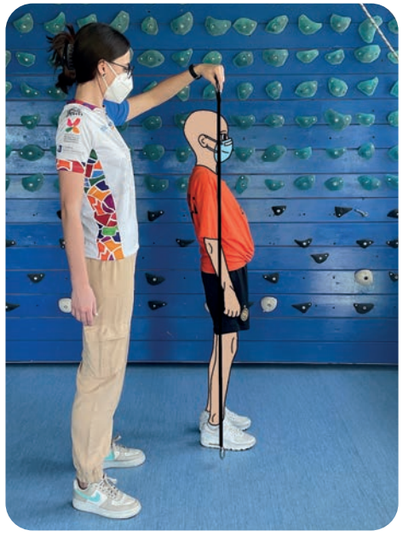
### ANTERIOR POSTURAL ALIGNMENT

This posture shows a marked anterior deviation of the body, with the plumb line passing through the balls of the feet. Body weight is shifted forward over the forefoot. The pelvis is in anterior tilt. The lumbar and cervical curves are hyperextended, with increased lordosis. The head is positioned forward.
There is a marked anterior deviation of the body relative to the plumb line, with weight carried anteriorly over the balls of the feet. Metatarsal arch supports may be indicated, together with correction of overall postural alignment.
The ankle joint is in slight dorsiflexion due to forward inclination of the lower limb and slight knee flexion.
The posterior muscles of the trunk and lower extremities tend to remain in a state of constant contraction; correction of alignment is required to promote effective muscle relaxation.



### POSTERIOR POSTURAL ALIGNMENT

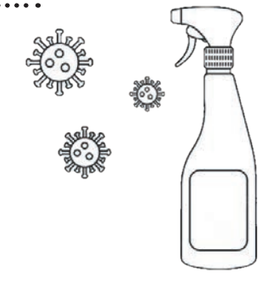
This posture shows a marked posterior deviation of the body, with the plumb line passing through the balls of the feet. Body weight is shifted backward. The pelvis is in posterior tilt. The lumbar and cervical curves are reduced or flattened. The head is positioned posteriorly.
There is a marked posterior deviation of the upper trunk and head.
The knees and pelvis are displaced anteriorly to counterbalance the posterior shift of the upper body.
The lumbar extensors and hip flexor muscles act together to control pelvic alignment.





31
JOINT'S RANGE OF MOTION / POSTURAL ALIGNMENT

# STANDARD OPERATING PROCEDURES



## PURPOSE

The following SOPs are implemented at the Centro Maria Letizia Verga – Clinica Pediatrica, Università degli Studi di Milano-Bicocca, Monza (Italy), where the consortium partner Fondazione Monza e Brianza per il Bambino e la Sua Mamma (MBBM) conducts the research project.

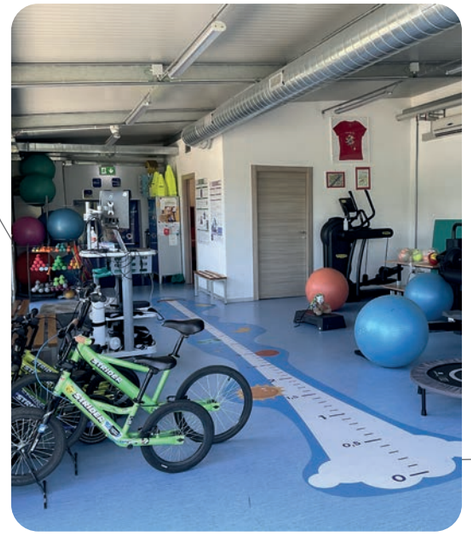


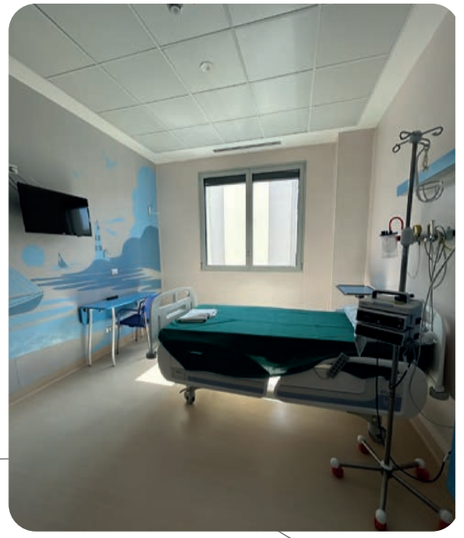


## SCOPE

**THE EVALUATION AND TRAINING ACTIVITIES TAKE PLACE IN:**

1. The gym located on the 3rd floor as well as in the nearby roof garden/outdoor gym.
2. The beds and rooms in the outpatient's clinic.
3. The rooms in the bone marrow transplant center.
4. The rooms in the haematology ward.
5. The stairs.





## SAFETY AND WARNINGS / CHEMICALS

### HAZARD

Denatured ethyl alcohol gel.

Didecyldimethylammonium chloride & polyhexamethylene biguanide hydrochloride solution.

Sodium hypochlorite solution.

### MANAGEMENT

When children are in proximity to a chemical hazard (e.g., hand sanitizer gel), an adult exercise professional directly supervises to ensure that no accidental ingestion or skin or eye contact occurs.

Chemical hazards used for disinfection purposes are stored in an inaccessible location for children.

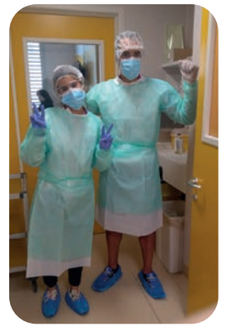


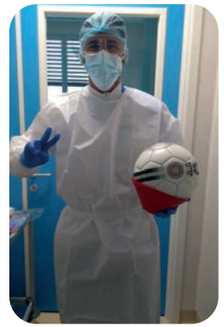





## SAFETY AND WARNINGS / BIOLOGICAL







### HAZARD

Blood.

Saliva and mucus droplets.

Sweat (perspiration).

Vomit.

Urine and faeces.

### MANAGEMENT

Each researcher and participant must clean their hands upon entering and after leaving the gym and each child's room. Disposable face masks are mandatory for everyone during all activities in the gym, including those conducted outdoor. In the wards and participant rooms, researchers must wear disposable gloves and face masks.
All participants undergoing gas exchange and respiratory tests, electrocardiography and anthropometric evaluation must use disposable bacterial filters and electrodes.

All personnel must wear personal protective equipment (PPE) at all times when dealing with biological hazards (e.g., cleaning pools of sweat, saliva, or vomit; applying medication for minor skin injuries; assisting young children requiring toilet use):

- Disposable gloves
- Closed-toe shoes.

In the case of children isolated due to specific viral, bacterial, or other infectious agents, all personnel must follow the procedures indicated by the Head Nurse prior to entering each room. Additional PPE must be worn (e.g., when patients are isolated due to multidrug-resistant bacteria or other viral or bacterial infections):

- Disposable laboratory gowns
- Eye protection
- Disposable surgical head caps
- Disposable surgical shoe covers.

## SAFETY AND WARNINGS / EYES INJURIES

### HAZARD

Near infrared spectroscopy (NIRS).

### MANAGEMENT

The exercise professional should not look directly at the light emitter of the NIRS probe. The probe should be switched on only once it is positioned on the participant's skin and firmly secured using medical bandages.
The NIRS probe should be switched off before removing the medical bandages.





## SAFETY AND WARNINGS / PHYSICAL HAZARDS

### HAZARD

Electric hazard: medical equipment.
Fire hazard: alcohol gel.

### MANAGEMENT

All medical electrical equipment must be evaluated by the hospital clinical engineering department.

No alcohol-based solutions must be stored inside the gym; the flame-resistant storage cabinet is under the supervision of the Head Nurse.


## SAFETY AND WARNINGS / MANUAL HANDLING

### HAZARD

In some cases, ergometers, the metabolic cart and the NIRS device may need to be moved.

### MANAGEMENT

Technical staff should be consulted and lifting aids should be used.
The metabolic cart, which includes ECG and spirometer equipment, has its own trolley. The same applies to the portable NIRS device.






## SAFETY AND WARNINGS / FALLS

### HAZARD

During training and evaluation sessions, participants may be at risk of falling due to the following factors:

1. Underlying medical conditions, such as neurological, cardiac or other disabling conditions.
2. Side effects of medication, physical inactivity and impaired balance.
3. Reduced mobility, cognition, and vision, particularly among those admitted to hospital for extended periods.

### MANAGEMENT

To prevent the risk of falling, the following procedures must be followed:

Use playground standards that require soft play surfaces and restricted fall heights.

Use harnesses, fall arrest systems, and safe scaffolding for activities involving climbing at height.

Ensure adequate staff-to-child ratios in the gym (2:9) and in ward rooms (1:1).

Ensure helmets are worn during cycling activities.

Participants in the gym are required to wear appropriate exercise clothing at all times, including running shoes and loose-fitting garments such as sports shorts and T-shirts.

Participants in the wards may wear pyjamas but are required to wear non-slip socks.

## INDUCTION AND COMPETENCY

### MANAGEMENT

All staff and researchers supervising evaluation and training sessions must be trained in accordance with the Standard Operating Procedures (SOPs). All individuals performing research activities in the gym and wards must undergo compulsory induction training, delivered by the exercise professional. Researchers should hold certification in First Aid and cardiopulmonary resuscitation (CPR) for both adults and paediatric populations, as well as training in general emergency procedures.






## RISK ASSESSMENT

### MANAGEMENT

It must be refered to the institutional risk assessment conducted by the Risk Manager.

| FONDAZIONE Monza e Brianza per il BAMBINO e la sua MAMMA onlus<br>SERVIZIO PREVENZIONE E PROTEZIONE | Documento di Valutazione dei Rischi | Rev. 0 | Pag. 1/20 |
|---|---|---|---|
| | | SPP-MAS-001 | |

**RELAZIONE di SOPRALLUOGO**
**per la**

**VALUTAZIONE dei RISCHI**

**TERZO PIANO**

**CENTRO MARIA LETIZIA VERGA**

**(Uffici, palestra)**

**piano 3 Nuova Palazzina**

# CLEANING AND SANITIZING

## WHO IS IN CHARGE

Conducted by the hospital cleaning company.

## MANAGEMENT

Removal of visible debris, dirt, and dust from surfaces (floors, toilets, sinks).
Reduction of the presence and growth of bacteria, viruses, microorganisms, and fungi on surfaces.






# DISINFECTING

## WHO IS IN CHARGE

Conducted by the exercise professional.

## MANAGEMENT

Killing microorganisms as specified on the product label. The following products will be used for disinfection:

Denatured ethyl alcohol – "Septaman™": a ready-to-use alcohol-based gel for rapid and effective hand disinfection. It is suitable for frequent use, particularly in healthcare settings.
Composition (per 100 g of product): alcohol 70 g, excipients, purified water up to 100 g.

Didecyldimethylammonium chloride & polyhexamethylene biguanide hydrochloride – "Surfasafe™": a disinfectant detergent formulated without perfume or alcohol. Its compact foam dispenser reduces aerosol generation and limits component volatility.
Composition (per 750 ml of product): didecyldimethylammonium chloride 1.4 mg/g; polyhexamethylene biguanide hydrochloride 0.96 mg/g.

Sodium hypochlorite – "Antisapril™": a disinfectant solution.
Composition (per 5 L of product): sodium hypochlorite 2.8% (active chlorine: 2.7%). A 5% working solution (50 ml of Antisapril per 1 L of water) is required to ensure effective disinfection against most pathogens commonly found in the respiratory system.

## DISINFECTING / FACE MASK AND WEARABLE LACET OF THE METABOLIC CART

### WHO IS IN CHARGE

Conducted by the exercise professional.

### MANAGEMENT

Full immersion in a 5% Antisapril solution for 30 minutes, followed by rinsing. Allow to dry in a clean area and store in a clean, closed container.





## DISINFECTING / METABOLIC CART BODY AND SPIROMETER

### WHO IS IN CHARGE

Conducted by the exercise professional.

### MANAGEMENT

Disinfect with Surfasafe™ using clean cloths between participants and prior to storage.

# DISINFECTING / TURBINE OF THE METABOLIC CART AND THE SPIROMETER

## WHO IS IN CHARGE

Conducted by the exercise professional.

## MANAGEMENT

Full immersion in a 5% Antisapril™ solution for 30 minutes, followed by rinsing. Allow to dry in a clean area and store in a clean, airtight container.

## AVOID DIRECT WATER FLOW!





# DISINFECTING / NIRS PROBE

## WHO IS IN CHARGE

Conducted by the exercise professional.

## MANAGEMENT

The probe must be covered with plastic wrap between participants. Disinfect with Surfasafe™ using clean cloths between children and prior to storage.

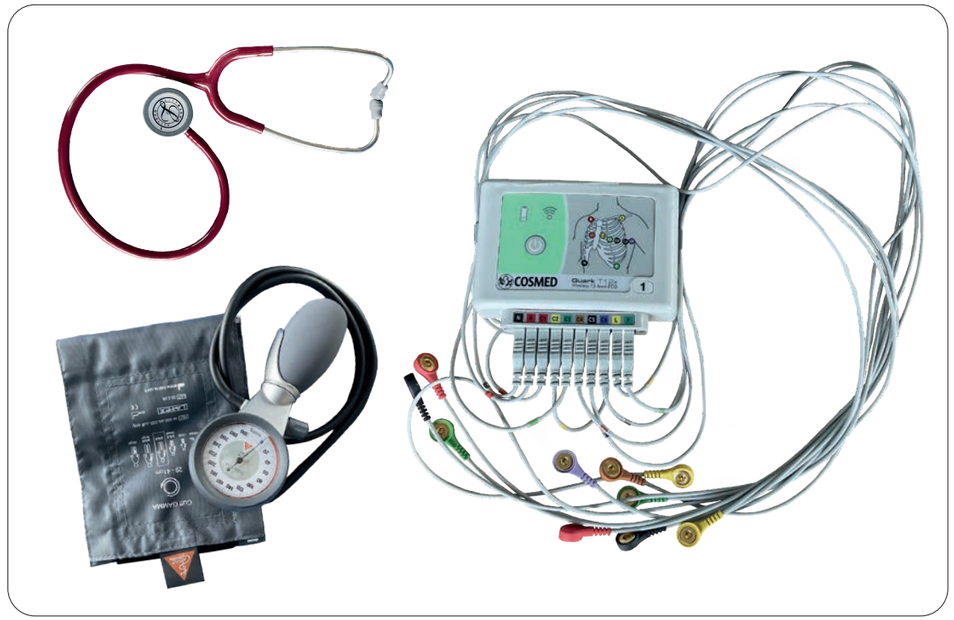
# DISINFECTING / ELECTROCARDIOGRAPH, SPHYGMOMANOMETER, STETHOSCOPE

## WHO IS IN CHARGE

Conducted by the exercise professional.

## MANAGEMENT

SurfasafeTM disinfection with clean cloths between participants and before storage.








# DISINFECTING / EXAMINATION COUCH

## WHO IS IN CHARGE

Conducted by the exercise professional.

## MANAGEMENT

Use disposable paper between participants.
Disinfect with Surfasafe™ using clean cloths between children and at the end of each evaluation session.

# DISINFECTING / HARNESS

## WHO IS IN CHARGE

Conducted by the exercise professional.

## MANAGEMENT

Surfasafetm disinfection with clean cloths between participants and before storage;

Must be washed once monthly;

Dry in a clean place and store in a closed box.





# DISINFECTING / TRAINING MACHINES

## WHO IS IN CHARGE

Conducted by the exercise professional.

## MANAGEMENT

Each participant must clean their hands using Septaman™ before starting the evaluation or training session on the ergometers.
Septaman™ must also be used between children and at the end of each training session.
Disinfect with Surfasafe™ using clean cloths between children and at the end of each evaluation session.

## DISINFECTING / TRAINING EQUIPMENTS

### WHO IS IN CHARGE

Conducted by the exercise professional.

### MANAGEMENT

Each participant must use their own equipment kit.
Disinfect with Surfasafe™ using clean cloths prior to storage.






## DISINFECTING / PULSE OXIMETER

### WHO IS IN CHARGE

Conducted by the exercise professional.

### MANAGEMENT

Septaman™ must also be used between participants and at the end of each training session.
Disinfect with Surfasafe™ using clean cloths between children and at the end of each evaluation session.

# BIOLOGICAL AND NON-BIOLOGICAL WASTE DISPOSAL

## WHO IS IN CHARGE

Conducted by the hospital cleaning company.

## MANAGEMENT

In the gym, no biological waste bins are used; waste is disposed of by the hospital cleaning company.
In the wards, biological waste bins are used for the disposal of biological waste. The institutional protocol for biological waste disposal is managed by the Head Nurse.




# EMERGENCY AND FIRST AID PROCEDURES



## WHO IS IN CHARGE

Conducted by the exercise professional.


## MANAGEMENT

All researchers must hold current First Aid and CPR certification. All sessions must be supervised by at least two exercise professionals.

**Emergency Procedures**

MBBM procedures are clearly displayed on the gym wall. The following information is reported on the "Medical Emergency" sign:

For assistance, dial the emergency number.

Remain with the patient until the Medical Response Team or Ambulance personnel arrive.

## EMERGENCY AND FIRST AID PROCEDURES

### WHO IS IN CHARGE

Conducted by the exercise professional.

### MANAGEMENT

**Cardiac Arrest**
In the event of cardiac arrest, the participant must be placed in a supine position. After confirming unresponsiveness and absence of normal breathing (or the presence of only occasional gasps), emergency assistance must be activated by contacting the territorial emergency medical services. A defibrillator must be requested immediately. Cardiopulmonary resuscitation (CPR) must be initiated without delay if no cardiac rhythm is detected. Defibrillation must be performed if a shockable rhythm is identified.

**Syncope**
In the event of syncope, the participant must be placed in a supine position. After confirming a drop in blood pressure with preserved vital signs, the participant's legs should be elevated. Vital signs must be continuously monitored until full recovery to baseline conditions. If necessary, the participant should be advised to seek medical attention.




EMERGENCY AND FIRST AID PROCEDURES

### WHO IS IN CHARGE

Conducted by the exercise professional.

### MANAGEMENT

**Unconsciousness**
In the event of unconsciousness without a drop in blood pressure, the participant must be placed in a supine position. If vital signs are stable, the recovery position should be applied and internal assistance must be alerted.

**Foreign Body Airway Obstruction (FBAO)**
In the event of choking, age-appropriate FBAO management must be performed (children or adults). If vital signs become unstable, internal assistance must be alerted. Cardiopulmonary resuscitation (CPR) must be initiated immediately. Defibrillation must be performed if a shockable rhythm is identified.

# EMERGENCY AND FIRST AID PROCEDURES

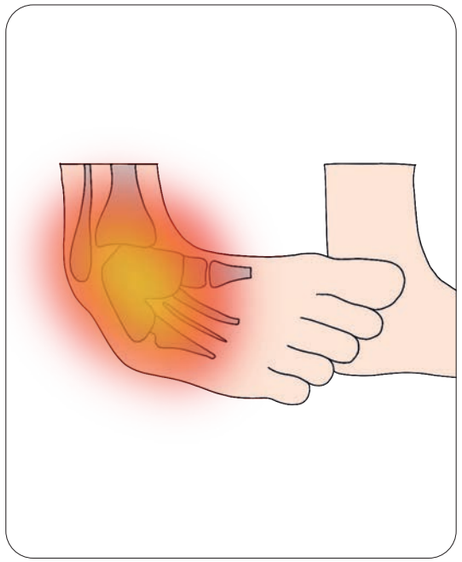
## WHO IS IN CHARGE

Conducted by the exercise professional.


## MANAGEMENT

**Musculoskeletal Trauma**
In the event of a bone fracture, the participant must be placed in a seated or supine position. An ice pack must be applied to the injured area, and internal assistance must be alerted.
In the case of a joint sprain or muscle strain, the participant must be placed in a seated or supine position, and an ice pack must be applied. The participant should be advised to seek medical attention within the following 48 hours, if necessary.

**Skin Injuries**
In the event of cuts, scratches, bruises, or lacerations, the participant must be placed in a seated or supine position. Careful cleaning, disinfection, and dressing of the affected area must be performed. The participant should be advised to seek medical attention within the following 48 hours, if necessary.







# MAINTENANCE

## WHO IS IN CHARGE

Verified by the exercise professional.


## MANAGEMENT

Equipment must be maintained in safe working order by exercise professionals and researchers.
Scheduled maintenance is performed annually by the manufacturer's service provider. All devices must be periodically evaluated by the Clinical Engineering Department following manufacturer maintenance.

## UNIFORMS

### WHO IS IN CHARGE

Conducted by the exercise professional.

### MANAGEMENT

All personnel involved in the FORTEe project must wear staff uniforms to ensure they are easily recognisable by healthcare personnel, exercise professionals, children, and their families.
Uniforms are personal items and must only be worn within one's own Center.
Any other use (e.g., leisure activities, travelling to and from work while wearing the uniform) is strictly prohibited.
Uniforms must be washed weekly and, when necessary, on a daily basis.




## DATA PROTECTION AND SOCIAL MEDIA

### WHO IS IN CHARGE

Run by the exercise professionals.

### MANAGEMENT

Personnel involved in the FORTEe project must receive induction training on data protection procedures.
Participant's personal data and research data must be stored on the PC available in the gym and protected by the appropriate department at the center.
Personnel involved in the FORTEe project must not use social media to connect with participants and/or their family members. Any requests for friendship or connection on social media must be declined.

FORTE europe

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 945153.