



## Synthetic Indices: Normalcy Index or Gillette Gait Index

Practical Session of the course  
"Basics in Motion Analysis" - TRAMA Network Project  
13- 21st September 2007



**FROM GAIT ANALYSIS**

**A LOT OF PARAMETERS**

Necessity of synthetic information

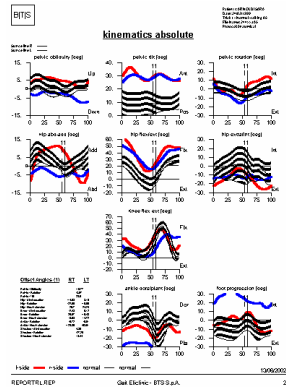
OLFA  
EUROPEAID  
CO-OPERATION OFFICE



## Normalcy Index or Gillette Gait Index



- It's a synthetic index that characterizes a subject's gait in a global sense (Schutte, 2000)
- It uses multivariate statistical methods to quantify the extent by which a patient's gait deviates from that of an unimpaired group → 16 kinematic variables obtained from GA



Time of toe off  
Walking speed  
Cadence

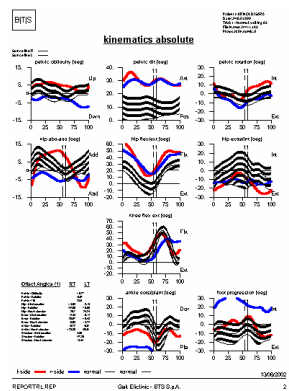
Temporal parameters

Mean pelvic tilt  
Range of pelvic tilt  
Mean pelvic rotation  
Minimum hip flexion  
Range of hip flexion  
Peak hip abduction in swing  
Mean hip rotation in stance  
Knee flexion at initial contact  
Time of peak knee flexion  
Range of knee flexion  
Peak of ankle dorsiflexion in stance  
Peak of ankle dorsiflexion in swing  
Mean foot progression angle

Kinematic parameters



## NI or GGI



$$NI = 381.41$$

(mean value normality = 16)  
Range: 4 – 32



How can we obtain Normalcy Index??

The diagram illustrates the process of obtaining a Normalcy Index. It starts with the EliteClinic software icon on the left, followed by a large green arrow pointing to the Microsoft Excel icon on the right. This indicates that data from EliteClinic is exported to Excel for further analysis.

Logos for OCLFA, EUROPEAID SUPERMOTIVE, and TRAMA are visible in the top right and bottom right corners.

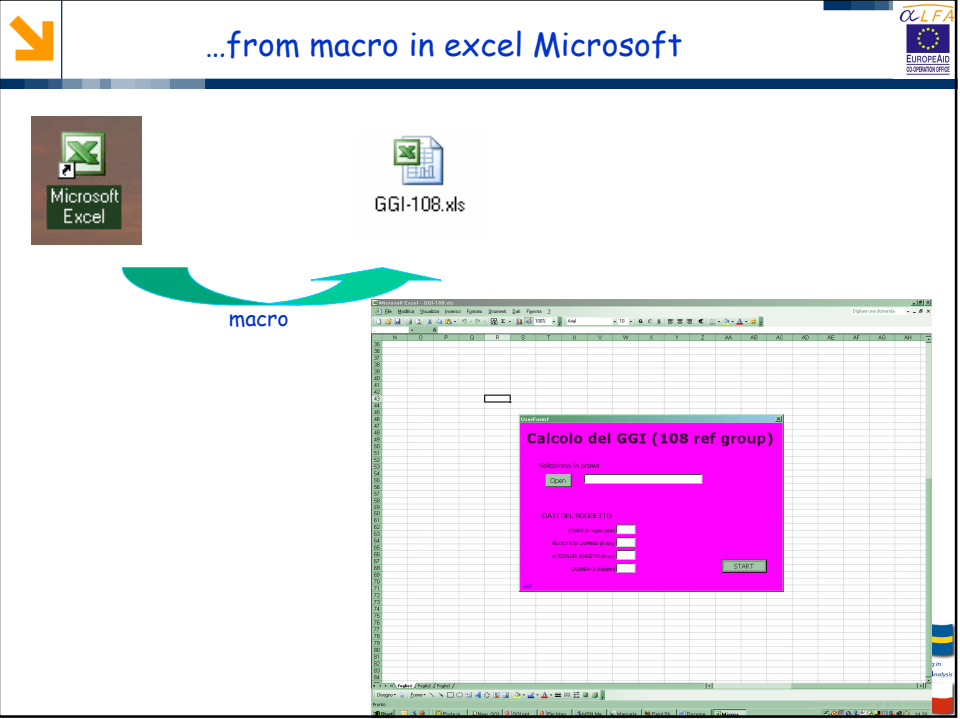
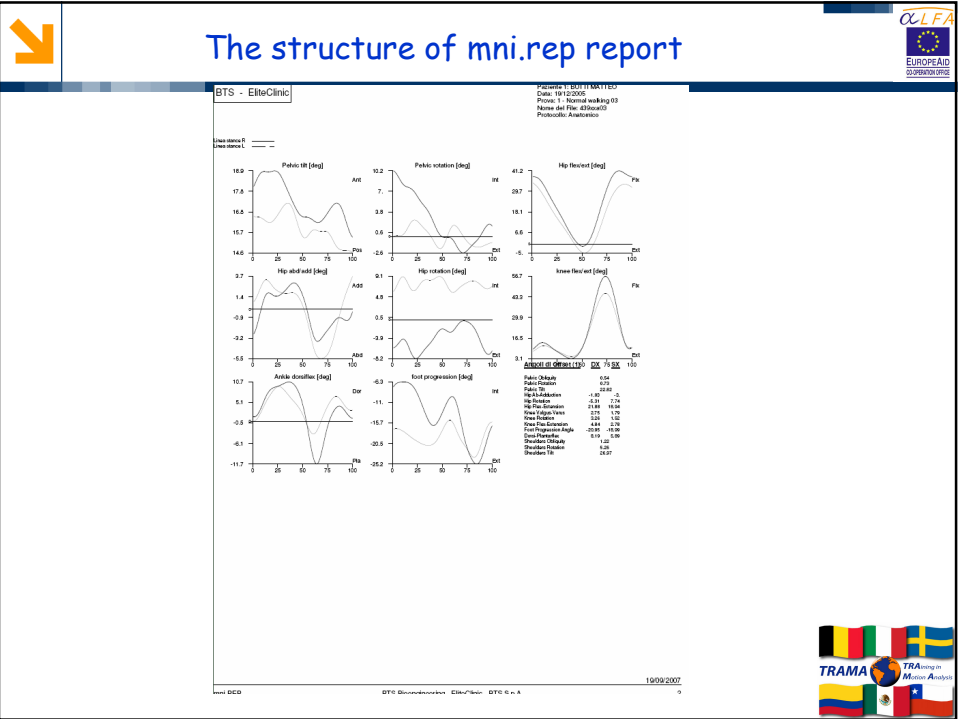
How can we obtain Normalcy Index??

We select a trial of Gait Analysis

The screenshot shows the 'Report' window in the EliteClinic software. The window contains various fields for patient information (Name, Surname, Sex, Age, Height, Weight, Pathology, Protocol) and checkboxes for 'Confronto con altra prova' and 'Confronto con i dati di Normalità'. The 'Classe di Confronto' is set to 'NIvCHILD' and 'Forma' is 'Forma 12'. The 'Modulo di Report' dropdown is set to 'none'. The 'Esport Ascii' button at the bottom is circled in red. A file icon labeled 'mni.rep' is shown to the left of the screenshot.

File .txt after ASCII export

Logos for OCLFA, EUROPEAID SUPERMOTIVE, and TRAMA are visible in the top right and bottom right corners.



CLFA  
EUROPEAID  
SOPRINTENDENZA

↓

UserForm1

### Calcolo del GGI (108 ref group)

Seleziona la prova

Open

DATI DEL SOGGETTO

STANZA (n. %gati cycle)

VELOCITA' DI CAMMINO (n. m/s)

ALTEZZA DEL SOGGETTO (n. cm)

CADENZA (n. step/min)

START

File .txt after ASCII export

TRAMA TRAMA  
MOTION ANALYSIS

CLFA  
EUROPEAID  
SOPRINTENDENZA

↓

UserForm1

### Calcolo del GGI (108 ref group)

Seleziona la prova

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DATI DEL SOGGETTO

STANZA (n. %gati cycle)

VELOCITA' DI CAMMINO (n. m/s)

ALTEZZA DEL SOGGETTO (n. cm)

CADENZA (n. step/min)

START

Microsoft Excel

Prova di arto sx?

SI No

Is it the left side?

TRAMA TRAMA  
MOTION ANALYSIS

CLFA  
EUROPEAN  
SUPERLITE

**Calcolo del GGI (108 ref group)**

Seleziona la prova

Open C:\GATEX\Protocol\_Roma\Gata\9\cva01.ppt.xls

**DATI DEL SOGGETTO**

STANZA (n steps/m)

VELOCITA' DI CARPINO (m/s) 1

ALTEZZA DEL SOGGETTO (m/cm) 121

CADENZA (n steps/m) 170

START

Microsoft Excel

Versione vecchia del software? (altret arkle-110?)

Si No

Is it the old version of software?

TRAMA TRAMA  
Motion Analysis

CLFA  
EUROPEAN  
SUPERLITE

**Calcolo del GGI (108 ref group)**

Seleziona la prova

Open C:\GATEX\Protocol\_Roma\Gata\9\cva01.ppt.xls

**DATI DEL SOGGETTO**

STANZA (n steps/m)

VELOCITA' DI CARPINO (m/s) 1

ALTEZZA DEL SOGGETTO (m/cm) 121

CADENZA (n steps/m) 170

START

Microsoft Excel

Standing built?

Si No

Is it good the standing trial?

TRAMA TRAMA  
Motion Analysis

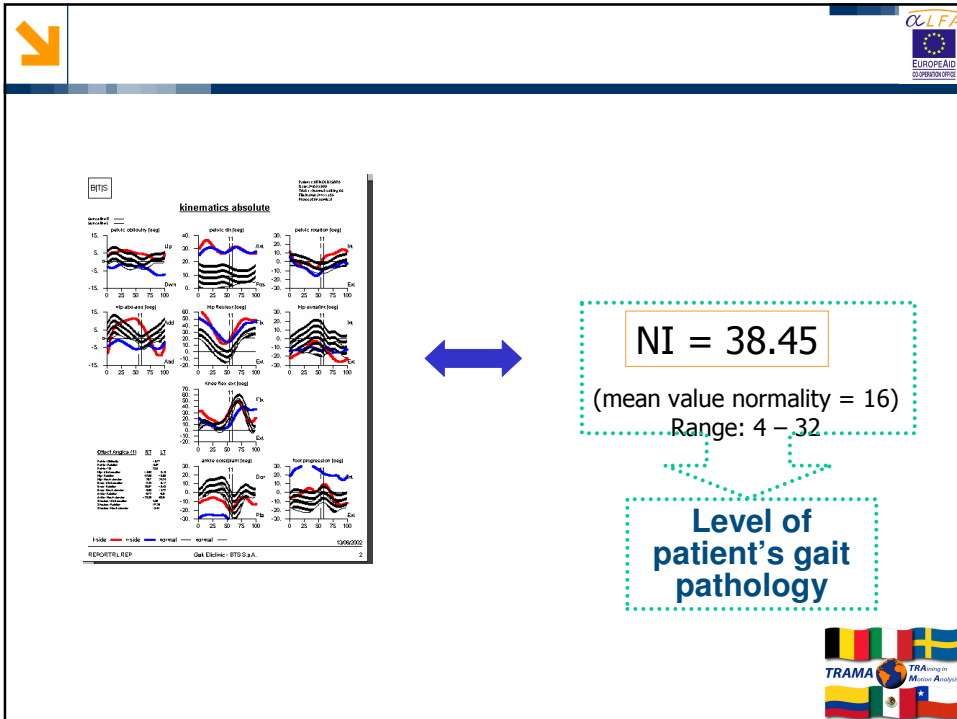
Do you want to save changes to 'normU30-108.xls'?

**ATTENTION!!!**

HERE THE ANSWER IS "NOT" - ALWAYS

PARAMETRI	referimento	diff pac-if	SENSITIVITY risp a x	SENSITIVITY risp a y	SENSITIVITY risp a z
1 istanza	50	2.213	p1	-3.52361	p1
2 velocità normalizzata	1.66289	1.6764	p2	10.66607	p2
3 cadenza (step/sec)	2.05	2.0179	p3	-3.29676	p3
4 Mean Pelvic Tilt	15.92516	9.3013	p4	1.263431	p4
5 ROM Pelvic Tilt	2.6202	4.1577	p5	-0.82378	p5
6 Mean Pelvic Rotation	0.048943	-0.3562	p6	-0.95036	p6
7 Mean Hip Flex-Ext	-4.86881	-0.0449	p7	-0.42088	p7
8 ROM Hip Flex-Ext	38.31934	43.5197	p8	-0.92565	p8
9 Peak Hip Add in swing	-5.49126	-2.5103	p9	-1.5099	p9
10 Mean Hip Roll in stance	7.57278	4.0259	p10	-0.11622	p10
11 Knee Flex IIC	7.62559	7.5269	p11	0.342943	p11
12 Timing of Max Knee Flex	74	70.8389	p12	4.46892	p12
13 ROM Knee Flex-Ext	41.29508	58.5951	p13	-1.82573	p13
14 Peak Ankle Dorsif in stance	9.48389	12.682	p14	-0.59646	p14
15 Peak Ankle Dorsif in swing	6.82184	5.8644	p15	0.79252	p15
16 Mean Foot progression in stance	-18.8172	-11.6623	p16	-0.54372	p16

GGI: 38.45



**NI quantifies in a global sense the gait pattern of a subject**

In particular it can be use :

- ∞ To quantify the level of functional limitation in subject with CP
- ∞ To quantify globally and synthetically the effect of a treatment on gait
- ∞ To monitor the effects of a treatment over time

The slide also features the TRAMA logo and flags in the bottom right corner.

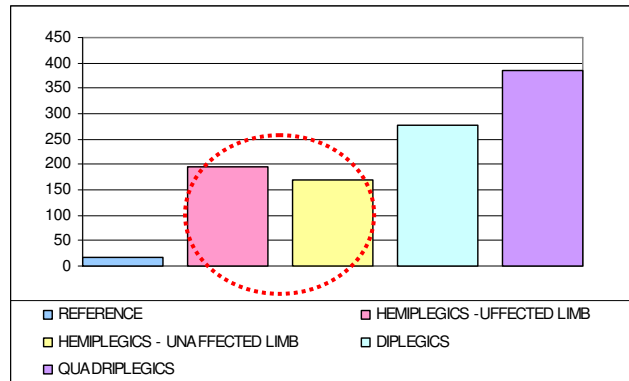




## NI or GGI in CP



144 CP patients  
12 healthy subjects



(Romei M. Galli M. et al. Gait Posture 2005)

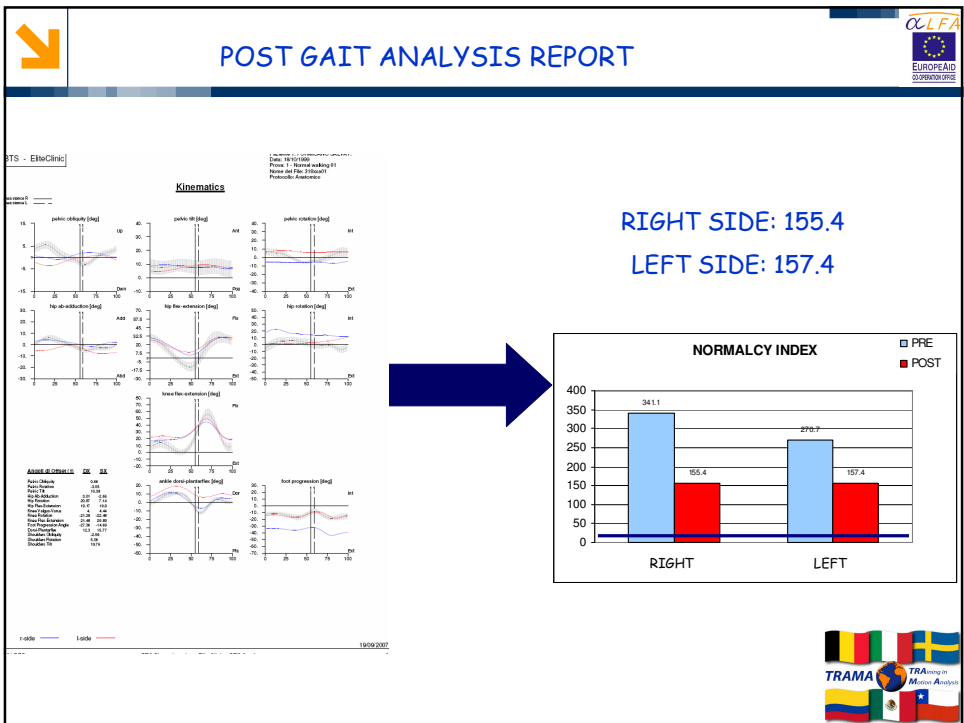
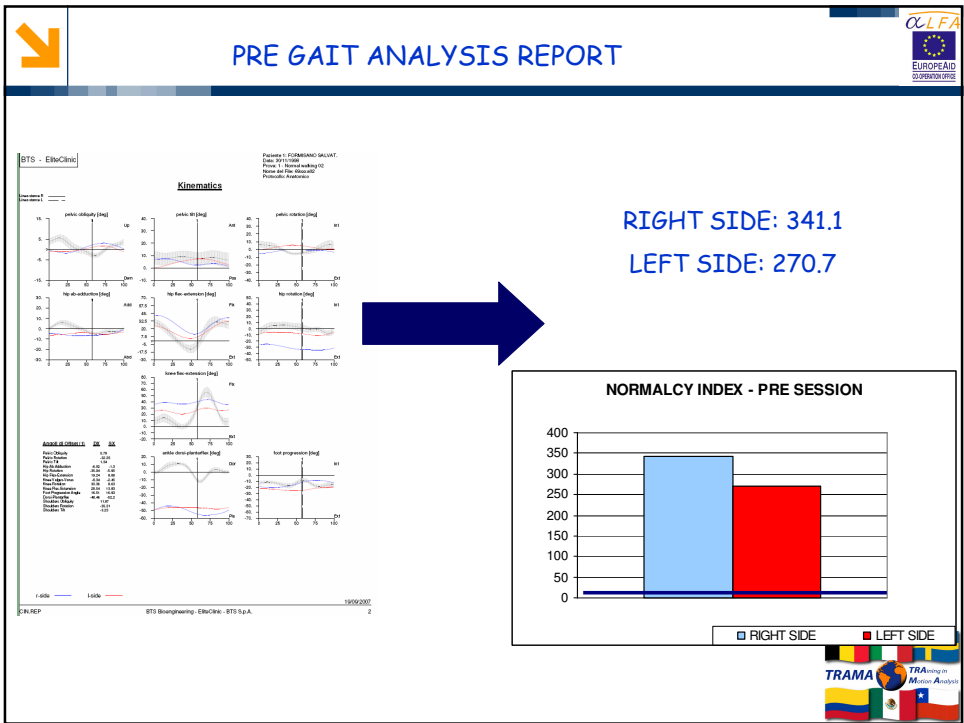


## NI quantifies in a global sense the gait pattern of a subject

In particular it can be use :

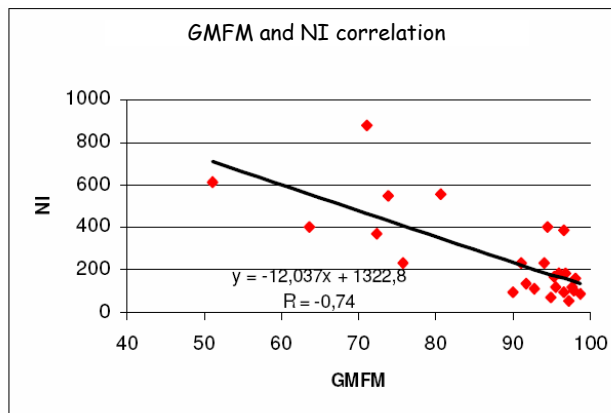
- ∞ To quantify the level of functional limitation in a subject with CP
- ∞ To quantify globally and synthetically the effect of a treatment on gait
- ∞ To monitor the effects of a treatment over time







## CORRELATION BETWEEN NI AND GMFM



A good correlation exists between GMFM and NI ( $R^2 = -0.74$ )

The higher is GMFM score the lower is NI value



## Main limitations of NI



- Only a value to characterize the gait pattern of the patient → the synthesis may be a limit
- The choice of parameters used to compute it
- The parameters are significant for CP. And for the other pathologies???
- It is computed starting only from kinematic parameters





## Synthetic index



Kinematics



Kinetics

