

**IAS
2022
JAPAN**

9th International Ankle Symposium

Instruments and Methods for the Assessment of Ankle Evertor Strength :

A systematic review of measurement properties

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Evertor Muscles

play a role in Lateral Ankle Sprain (LAS) context



Evertor Conteract LAS
injury movement

Tropp. 1989. Int J Sports Med.
Young et al. 2021. Strength Cond J.



Precontracted and
strong evertor protect
ankle at footstrike

Ashton-Miller et al. 1996. Am J Sports Med.



Evertor weaknesses in
Chronic ankle instable
patient

Khalaj et al. 2020. Br J Sports Med.

Evertor Strength Assessment

To care Lateral Ankle Sprain (LAS)



Isokinetic
Dynamometer



Hand-Held
Dynamometer

No Evertor Strength
Deficit

- Focus on the other parameters

Evertor Strength Deficit

- Improve strength
- Assess during rehabilitation
- Return-to-play control



Objective

Evaluate

the reliability and measurement error
of instruments and their methods
to measure evertor strength



Eligibility Criteria

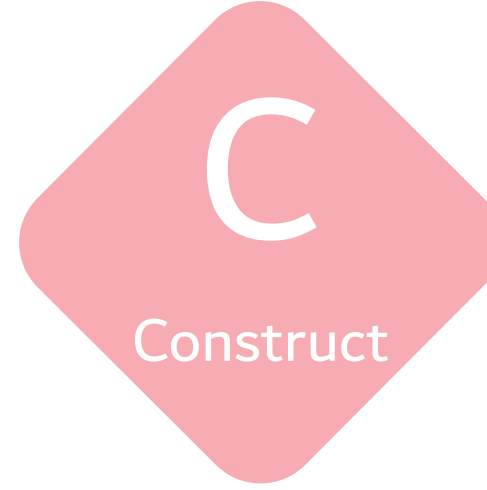
Pico for reliability and measurement error study



Human
(no cadaveric)



Any type of instruments and methods
to quantitatively assess evector
strength (no manual assessment)

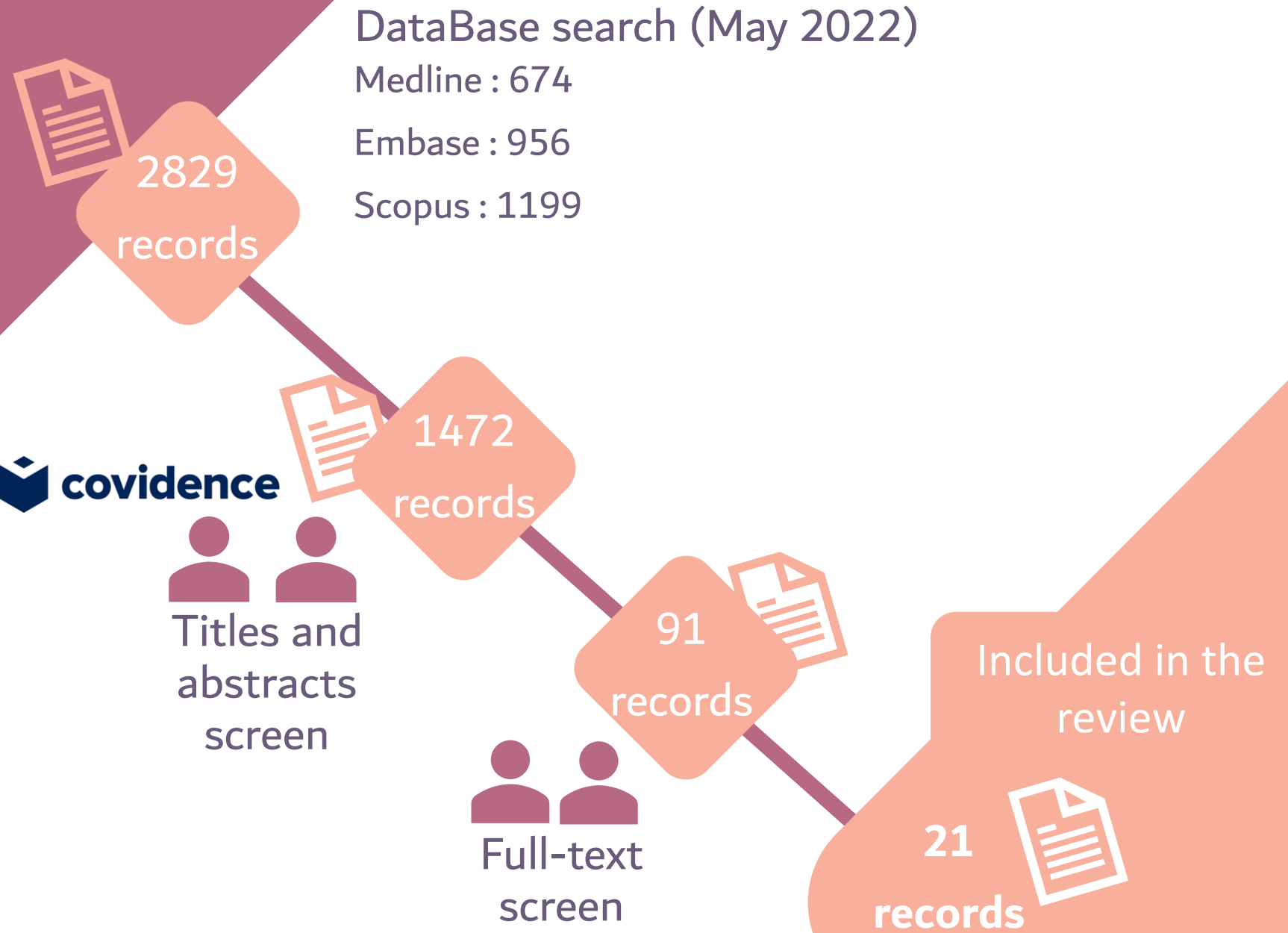


Reliability
Measurement error

- ◆ French and English paper
- ◆ No date restriction

JBI recommendations

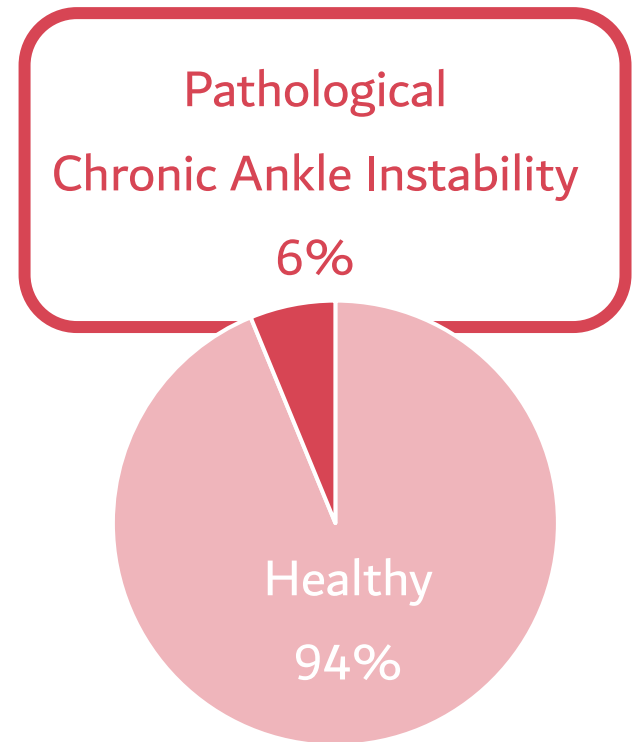
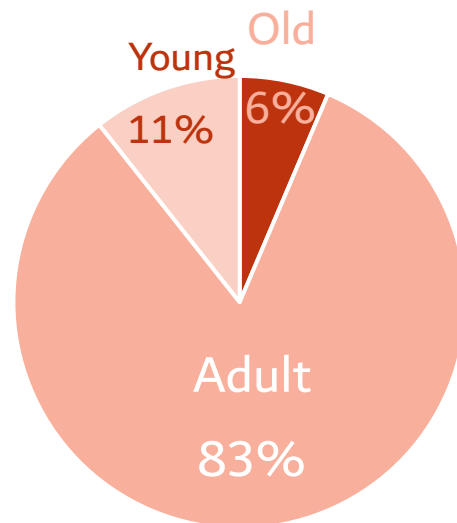
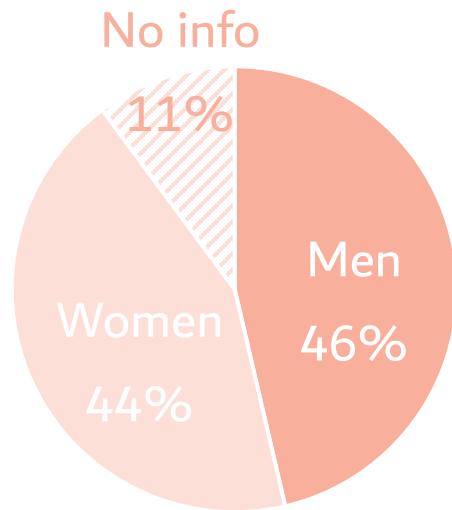
Search Strategy



Population n=563

Mainly Adult and Healthy

P
population



Quality

21 studies

COSMIN risk of bias

29%

Adequate

42%

Doubtful

29%

Inadequate

X Blinding process

X Time between session

X lack of one statistical index (ICC or r) / (SEM, MDC or LoA)

Two indices necessary for quality

Reliability and Measurement error

Reliability
= relative reliability

→ Distinguish score between patient

Sufficient reliability
ICC or $r \geq 0.70$

(Intraclass Correlation Coefficient)

Prinsen et al. 2016. Trial.

Measurement error
= absolute reliability

→ How close are score of repeated
measurement in stable patient
→ Magnitude of error

Sufficient Measurement error

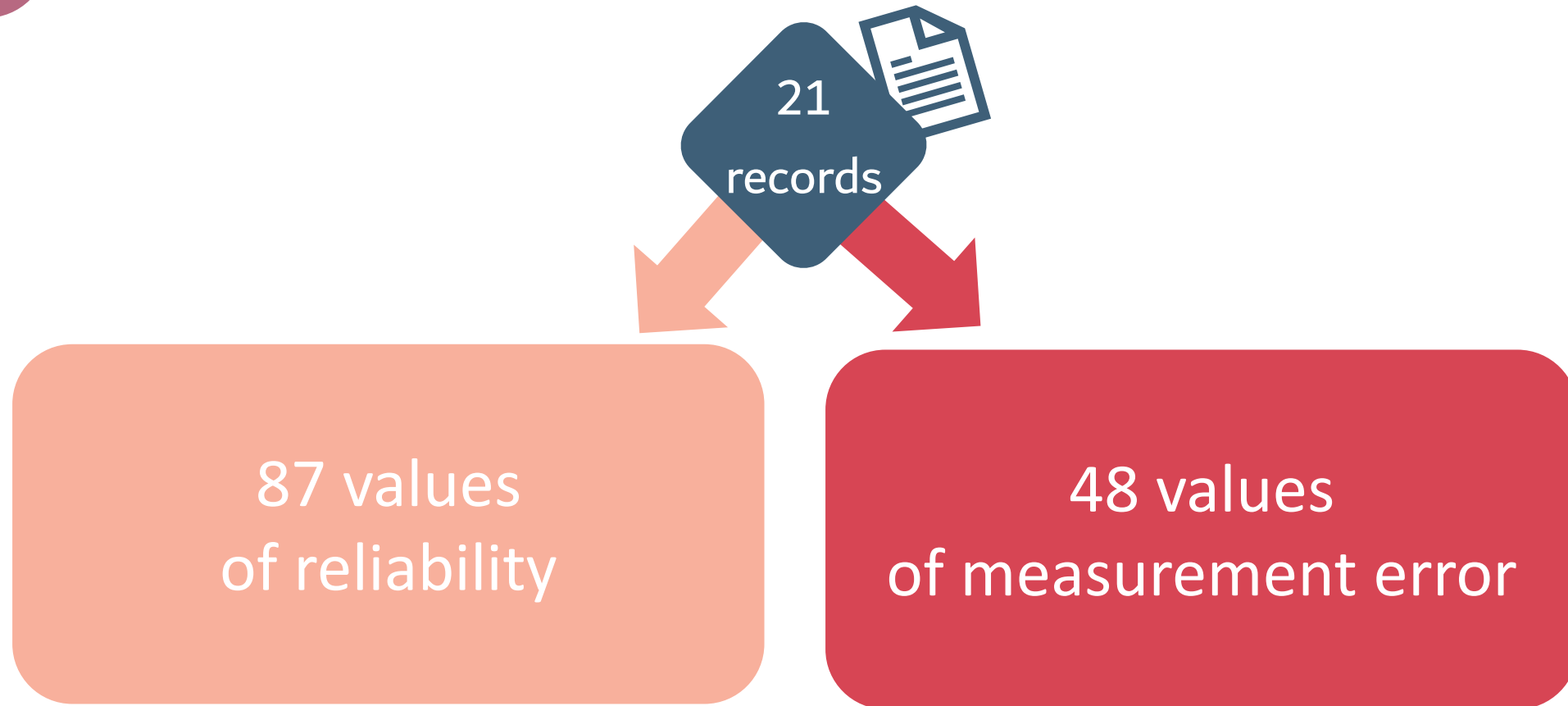
MDC or LoA $\leq 20\%$

(Minimal Detectable Change or Limit of Agreement)

Dvir. 2003. Isokinet Exerc Sci.

Extracted values

Reliability and Measurement error



Few sufficient measurement error

Reliability and Measurement error

Sufficient reliability
ICC or $r \geq 0.70$

81%

Test – Retest

89%

Inter – Rater

Sufficient Measurement error
MDC or LoA $\leq 20\%$

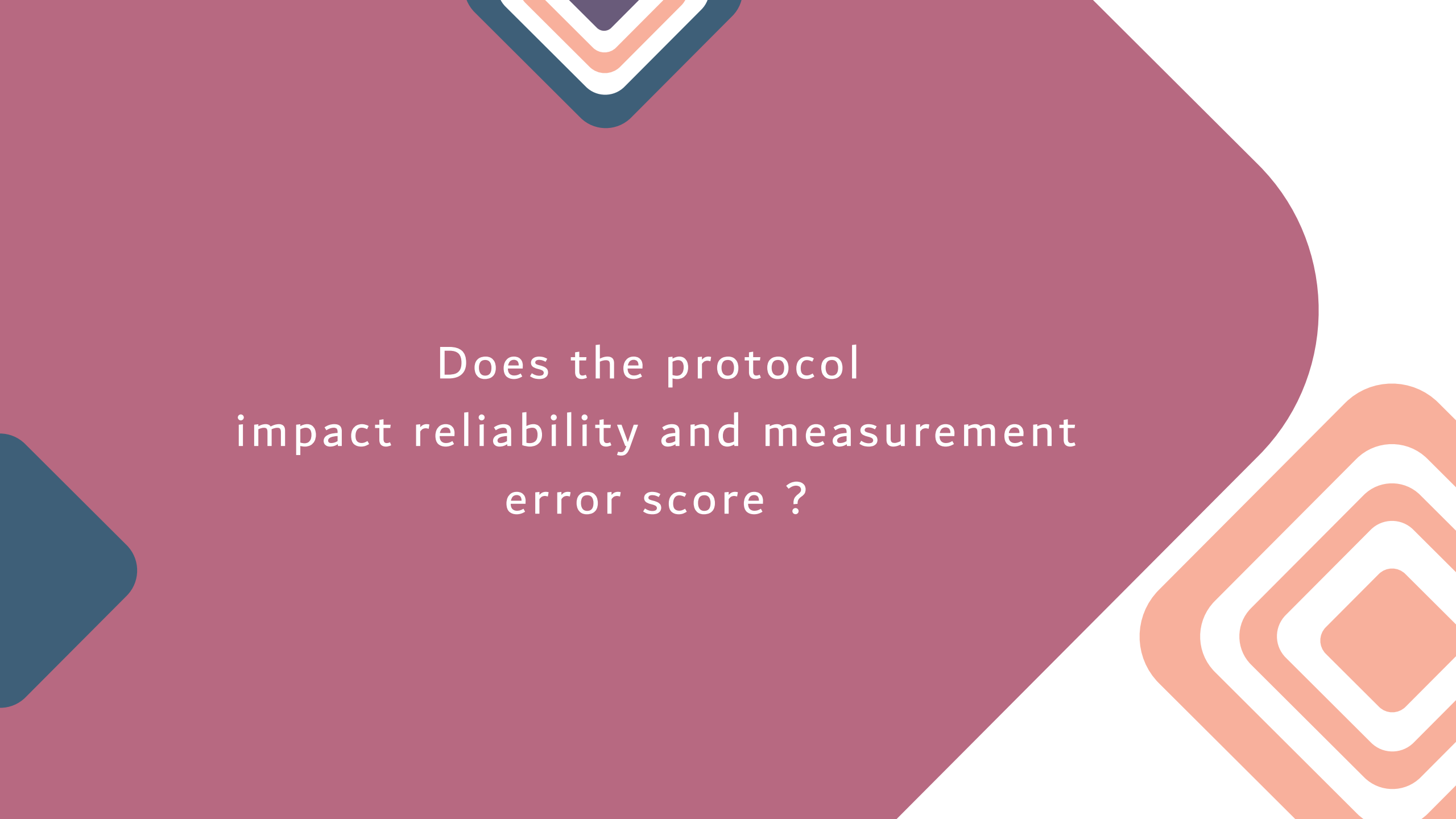
MDC or LoA $\leq 20\%$

35 %

Test – Retest

60 %

Inter – Rater



Does the protocol
impact reliability and measurement
error score ?

Contraction mode

Impact the measurement error

Concentric, eccentric and isometric mode are reliable
(more 77% of sufficient values ICC or $r \geq 0.70$)

BUT

Isometric mode present the best proportion of
sufficient **measurement error values**

(MDC or LoA $\leq 20\%$)

Concentric
13%

Eccentric
50%
(but only 4 values
analysed)

Isometric **
63%

Verbal encouragement

Impact the measurement error

Evertors strength assessment are reliable with and without verbal encouragement (more 77% of sufficient ICC or $r \geq 0.70$)

BUT

No sufficient measurement error (MDC or LoA $\leq 20\%$) without verbal encouragement



No verbal
encouragement
0%

With verbal
encouragement *

48%

Stabilisation

Impact the reliability (inter-rater)



Better proportion of sufficient reliability values **with external stabilisation** (ICC or $r \geq 0.70$)

Self stabilisation
0%

Belt or strap
stabilisation

80%

Manual
Stabilisation *

100 %

Type of instrument

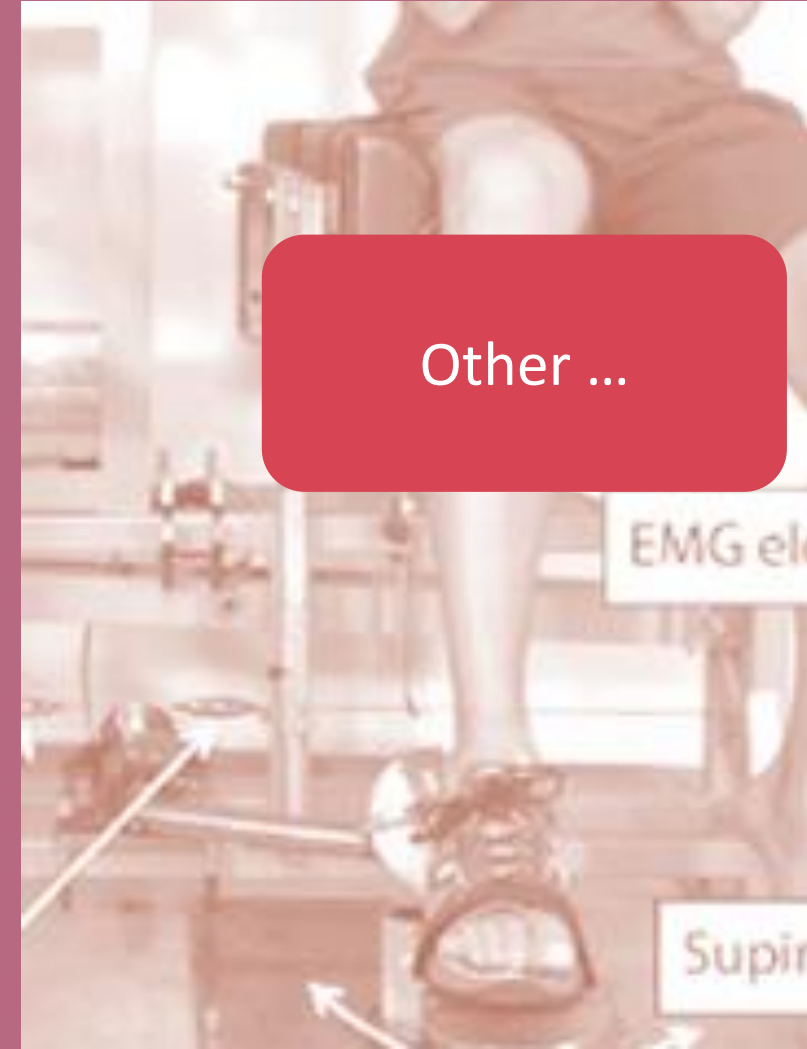
Do not impact the reliability and measurement error



Hand-Held
Dynamometer



Isokinetic
Dynamometer



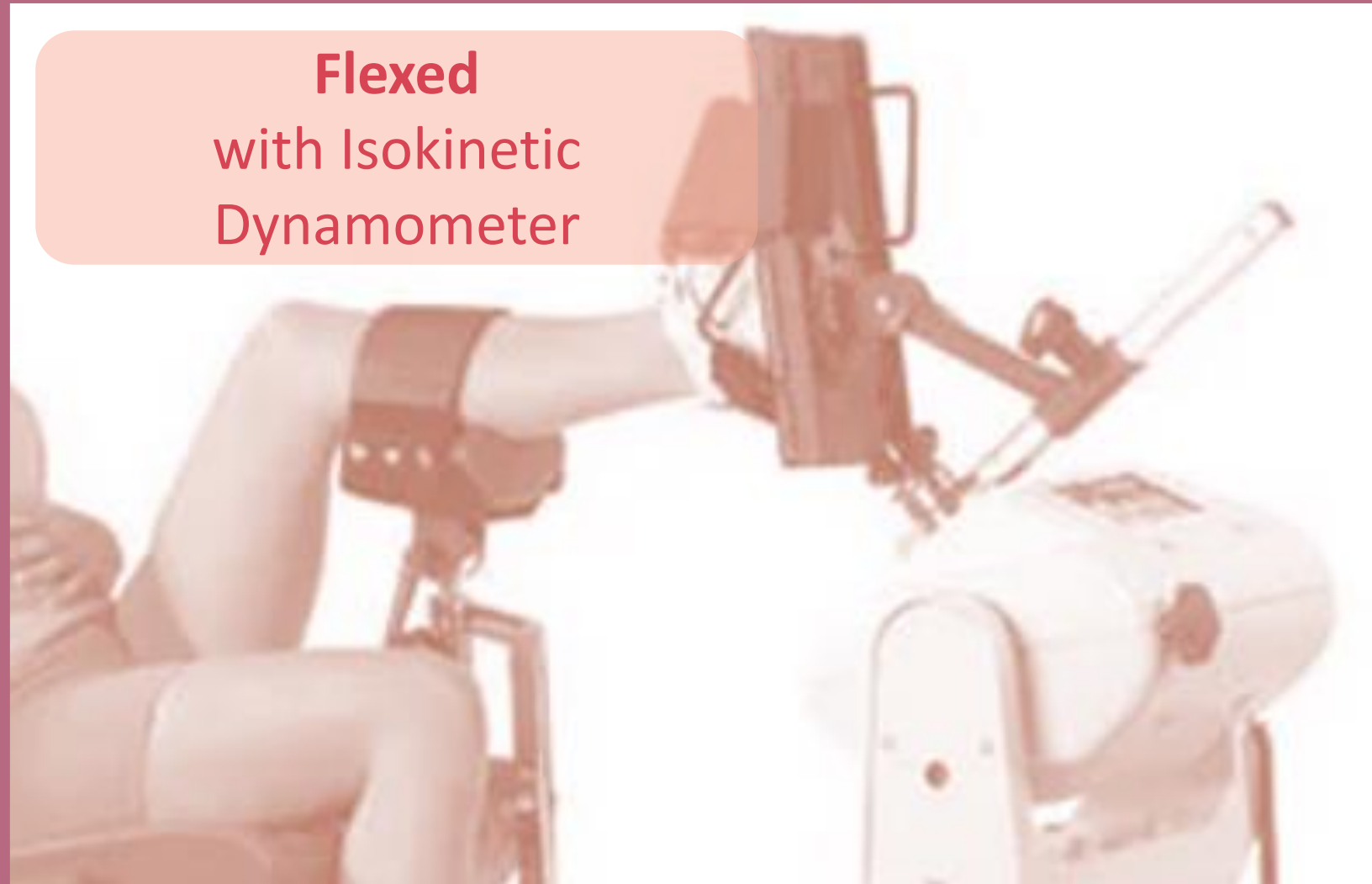
Other ...

Knee position

Do not impact the reliability and measurement error



Extended
with Hand-Held
Dynamometer



Flexed
with Isokinetic
Dynamometer

Familiarisation and test

Do not impact the reliability and measurement error

More repetitions with Isokinetic dynamometer than with Hand-Held dynamometer

? Dynamic movement vs Isometric movement ?



Visual feedback

Do not impact the reliability and measurement error

But higher evtor strength values

Evertors strength are 5% higher with visual feedback than without visual feedback

Hagen et al. 2015. J Foot Ankle Res.



As well with verbal encouragement
Strength values are higher than
without verbal encouragement

Amagliani et al. 2010. Int J Exerc Sci.

Limits

Quality
of the studies

Only French and
English paper

Focus on evertor
strength

Conclusion

Currently to be reliable to assess evertor strength

Hand-Held Dynamometer
or Isokinetic Dynamometer
in **Isometric mode**

Standardized protocol with

- **Stabilisation** (belt or manual)
- **Verbal encouragement**

Still unclear ...

? dynamic contraction still have high measurement error ?

? patient with a history of lateral ankle sprain (HHD)?



Thank you

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Publication orbi

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ANKLE EVERTOR STRENGTH

Systematic review

Aude Aguilaniu et al.