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# Selecting an appropriate motion sensor in children and adolescents



Numerous methods are available to measure physical activity in youth, such as doubly labeled water, direct observation, (in)direct calorimetry, heart rate monitoring, motion sensors, questionnaires, diaries, and interviews. Because many children and adolescents have difficulties in accurately recalling their physical activities, motion sensors are being used with increasing regularity. Few studies have evaluated and compared the published evidence of the clinimetric quality of different motion sensors.

## Conclusions

From this study it can be concluded that:
- The CSA/ActiGraph is the most studied motion sensor in children and adolescents. There is extensive evidence for a good reproducibility, validity, and feasibility of the CSA/ActiGraph in healthy children and adolescents (reproducibility: 4-18 yr; validity: 3-18 yr).
- There is no information on the reproducibility of motion sensors in preschool children (2-4 yr).
- There is no information on the reproducibility of three-dimensional accelerometers.

Because the technology of motion sensors is still improving, we can expect models to continue to change. Researchers and practitioners are strongly encouraged to regularly assess and report the clinimetric properties of the devices they use, although not without improving the quality of the reported information.

## More information

The purpose of the present study was to systematically review published evidence on the reproducibility, validity, and feasibility of motion sensors used to assess physical activity in healthy children and adolescents (2-18 yr).

## Method

A systematic literature search was performed in October 2004 in PubMed, Embase, and SpycINFO. The clinimetric quality of two pedometers (Digi-Walker, Pedoboy), four one-dimensional accelerometers (LSI, Caltrac, Actiwatch, CSA/ActiGraph), and three three-dimensional accelerometers (Tritrac-R3D, RT3, Tracmor2) was evaluated and compared using a 20-item checklist.

## Results

Overall, the quality of the studies (n = 35) and therefore the level of evidence for the reproducibility, validity, and feasibility of the motion sensors was modest (mean = 6.4 ± 1.6 out of 14 points). There was strong evidence for a good reproducibility of the Caltrac in adolescents (12-18 yr), a poor reproducibility of the Digi-Walker in children (8-12 yr), a good validity of the CSA/ActiGraph in children and adolescents (8-18 yr), and a good validity of the Tritrac-R3D in children (8-12 yr).

## Level of evidence for the reproducibility and validity of motion sensors per age group

| Motion sensor | Reproducibility | | | | Validity | | | |
|---|---|---|---|---|---|---|---|---|
| | 2-4 yr | 4-8 yr | 8-12 yr | 12-18 yr | 2-4 yr | 4-8 yr | 8-12 yr | 12-18 yr |
| Digi-Walker | ? | ? | --- | ? | ? | ++ | ±± | ? |
| Pedoboy | ? | ? | ? | ? | ? | ? | -- | -- |
| LSI | ? | ? | ? | ? | ± | ± | ? | ? |
| Caltrac | ? | ? | ? | +++ | ±± | ±± | ±± | ±± |
| Actiwatch | ? | ? | ? | ? | ±± | ++ | ++ | ++ |
| CSA/ ActiGraph | ? | ++ | ++ | ++ | ++ | ++ | +++ | +++ |
| Tritrac-R3D | ? | ? | ? | ? | ? | ±± | +++ | ++ |
| RT3 | ? | ? | ? | ? | ? | ? | ++ | ? |
| Tracmor2 | ? | ? | ? | ? | ++ | ++ | ++ | ? |