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Literature Review: Development of Cycling Skills in Childhood

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ADMINISTRATIVE INFORMATION

Support - Starter Grant (RUG).

Review Stage at time of this submission - Data extraction.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202630088

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 24 March 2026 and was last updated on 24 March 2026.

INTRODUCTION

Review question / Objective What motor/sensory, cognitive and environmental components contribute to the acquisition or improvement of two-wheeled cycling skills in children and adolescents (≤18 years), and how are these components targeted in existing interventions aimed at promoting safe and independent cycling?

P (Population)
Children and adolescents (≤18 years) who are learning to ride a conventional two-wheeled bicycle or already ride and aim to improve cycling skills or safety.
I (Intervention / Exposure)
Observational studies examining skill acquisition or interventions aimed at teaching cycling, improving cycling skills, or enhancing safety via motor, cognitive, or environmental components.
C (Comparator)
Control groups in intervention studies (usual practice, no intervention, alternative intervention) or pre-post designs in within-subject studies.
O (Outcome)
Motor, cognitive, and environmental components of learning or improving cycling; skill acquisition; performance measures; safety outcomes (e.g., road-ready competence, fall frequency, confidence).

Rationale Nowadays, children are exercising less and less. In 2018, only one in four 11-year-olds and one in seven 15-year-olds in Europe were physically active for at least one hour a day at a moderate to intense level. The decline in active travel to school plays an important role in this lack of exercise; children are cycling less and less at a young age. Children are often taken to school by car or cargo bike because of heavy traffic and infrastructure that is perceived as unsafe. As a result, children have fewer opportunities to master cycling at a young age.

Cycling is a complex skill that involves both motor and cognitive components. Basic motor skills such as balancing and pedalling, but also cognitive functions such as attention, anticipation and decision-making are necessary to navigate traffic safely. In this project, we investigate how children learn to cycle and develop effective learning strategies. These learning strategies also focus on special groups, such as children with motor, attention and sensory processing problems (i.e., Developmental Coordination Disorder/DCD, Attention Deficit Hiperactivity Disorder/ADHD, Autism Spectrum Disorders/ASD).

Condition being studied Not being able to cycle in children at an older age.

METHODS

Search strategy Pubmed:

```
(
"Child, Preschool"[Mesh] OR
"Child"[Mesh] OR
preschool*[tiab] OR
child*[tiab] OR
adolescen*[tiab] OR
youth[tiab] OR
teenager*[tiab]
)
AND
(
"Bicycling"[ti] OR
bicycl*[ti] OR
cycling*[ti] OR
"bike rid*"[ti] OR
"bicycle rid*"[ti] OR
"balance bike"[ti] OR
bike*[ti]
)
AND
(
learn*[tiab] OR
"motor learning"[tiab] OR
"skill acquisition"[tiab] OR
"motor development"[tiab] OR
"sensorimotor development"[tiab] OR
"sensory-motor development"[tiab] OR
"motor skills"[tiab] OR
develop*[tiab] OR
teach*[tiab] OR
education*[tiab] OR
train*[tiab] OR
practi*[tiab] OR
participation[tiab] OR
cognitive[tiab] OR
"cognitive development"[tiab] OR
"physical activity"[tiab] OR
environment*[tiab] OR
communication[tiab] OR
constraint*[tiab]
)
NOT
(
injury[tiab] OR
accident*[ti] OR
trauma[tiab] OR
helmet[tiab] OR
infrastructure[tiab] OR
"injury prevention"[tiab] OR
"traffic accident*"[tiab]
)
```

PsychInfo:

```
(
SU("Children") OR SU("Preschool Children")
OR TI(preschool* OR child* OR adolescen* OR youth OR teenager*)
OR AB(preschool* OR child* OR adolescen* OR youth OR teenager*)
)
AND
(
TI("bicycling" OR bicycl* OR cycling* OR "bike rid*" OR
"bicycle rid*" OR "balance bike" OR bike*)
)
AND
(
TI(
learn* OR "motor learning" OR "skill acquisition" OR
"motor development" OR "sensorimotor development" OR
"sensory-motor development" OR "motor skills" OR
develop* OR teach* OR education* OR train* OR practi* OR
participation OR cognitive OR "cognitive development" OR
"physical activity" OR environment* OR communication OR constraint*
)
OR
AB(
learn* OR "motor learning" OR "skill acquisition" OR
"motor development" OR "sensorimotor development" OR
"sensory-motor development" OR "motor skills" OR
develop* OR teach* OR education* OR train* OR practi* OR
participation OR cognitive OR "cognitive development" OR
```

"physical activity" OR environment* OR communication OR constraint*
)
)
NOT
(
TI(injury OR accident* OR trauma OR helmet OR infrastructure
OR "injury prevention" OR "traffic accident*")
OR
AB(injury OR accident* OR trauma OR helmet OR infrastructure
OR "injury prevention" OR "traffic accident*")
)

Embase:

(
'preschool child'/exp OR
'child'/exp OR
preschool*:ti,ab OR
child*:ti,ab OR
adolescen*:ti,ab OR
youth:ti,ab OR
teenager*:ti,ab
)
AND
(
bicycling:ti OR
bicycl*:ti OR
cycling*:ti OR
'bike rid*':ti OR
'bicycle rid*':ti OR
'balance bike':ti OR
bike*:ti
)
AND
(
learn*:ti,ab OR
'motor learning':ti,ab OR
'skill acquisition':ti,ab OR
'motor development':ti,ab OR
'sensorimotor development':ti,ab OR
'sensory-motor development':ti,ab OR
'motor skills':ti,ab OR
develop*:ti,ab OR
teach*:ti,ab OR
education*:ti,ab OR
train*:ti,ab OR
practi*:ti,ab OR
participation:ti,ab OR
cognitive:ti,ab OR
'cognitive development':ti,ab OR
'physical activity':ti,ab OR
environment*:ti,ab OR
communication:ti,ab OR
constraint*:ti,ab
)
NOT
(
injury:ti,ab OR
accident*:ti OR
trauma:ti,ab OR
helmet:ti,ab OR
infrastructure:ti,ab OR
'injury prevention':ti,ab OR
'traffic accident*':ti,ab
).

Participant or population Typical developing children and children with neurodevelopmental disorders (for example: ADHD, ASD, DCD, DS).

Intervention Various cycling interventions.

Comparator Any type of training versus no training.

Study designs to be included All study designs.

Eligibility criteria Inclusion: written in English, peer reviewed. Less than 18 years old.

Exclusion: Not written in English, not full article available.

Information sources
Pubmed
Embase
PsychInfo
Manually through references of articles from the three databases above.

Main outcome(s) motor/sensory, cognitive and environmental components.

Data management
Rayyan for screening,
Excel for data extraction,
Zotero for storing and reading files
All systems are shared between authors.

Quality assessment / Risk of bias analysis COSMIN quality assessment and other quality of assessments dependent on the design of the study.

Strategy of data synthesis First, the included articles are categorized according to the research question. Subsequently, relevant data are systematically extracted and entered into a structured data extraction table. This table includes information on study characteristics (e.g., authors, year, location, and study design), participant characteristics (e.g., group composition, sample size, sex, and age), and

outcome measures (motor, cognitive, environmental, and other outcomes).

Each article is independently reviewed and extracted by two researchers to ensure accuracy and reliability. Any discrepancies are discussed and resolved by consensus.

In addition, details regarding the intervention (e.g., duration, frequency, content, and involved stakeholders), measurement instruments, significant results, and identified facilitators and barriers are recorded. Pre-, post-, and follow-up results (including effect sizes) are also documented. Finally, the main findings, directions for future research, and implications for intervention development are summarized.

Subgroup analysis N.A.

Sensitivity analysis N.A.

Language restriction Only English.

Country(ies) involved The Netherlands.

Keywords children; adolescents; cycling; bicycle riding; motor skills; cognitive skills; sensory skills; balance; coordination; skill acquisition; performance; safety; intervention; training; environment.

Dissemination plans Presentation at conference. Publication in a peer reviewed journal.

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