

## University of Groningen

### Infants at very high risk of cerebral palsy

Hielkema, Tjitske

**IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.**

*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*

2017

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Hielkema, T. (2017). *Infants at very high risk of cerebral palsy: a challenging population*. Rijksuniversiteit Groningen.

**Copyright**

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

**Take-down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

*Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.*

## **Infants at very high risk of cerebral palsy**

- a challenging population -

Tjitske Hielkema

The studies presented in this thesis have been carried out with help of several funders.

The LEARN2MOVE 0-2 years project is part of the Dutch national LEARN2MOVE research programme, financially supported by ZonMw, Johanna Kinderfonds, Stichting Rotterdam Kinderrevalidatie Fonds Adriaan Stichting, Revalidatiefonds, Phelps Stichting, Revalidatie Nederland and the Nederlandse Vereniging van Revalidatieartsen. The VIP-project was financially supported by the Johanna KinderFonds, Stichting Fonds de Gavere, the Cornelia Stichting, and the Graduate School for Behavioural and Cognitive Neurosciences (BCN).



Financial support for the printing of this thesis was kindly provided by non commercial grants of Lewis Seating Systems, Etac R82 BV, Universitair Medisch Centrum Groningen, Centrum voor Revalidatie, Rijksuniversiteit Groningen, Stichting Beatrixoord Noord-Nederland, D.H. Heijne Stichting / Basko Healthcare, OIM orthopedie (Assen, the Netherlands), Otto Bock, Ipsen Farmaceutica BV, Nutricia Advanced Medical Nutrition



ISBN (printed version): 978-94-6299-640-3

ISBN (electronic version): 978-94-6299-645-8

Cover Design: Hidde en Teun

Lay-out: Nikki Vermeulen - Ridderprint BV

Printing: Ridderprint BV - [www.ridderprint.nl](http://www.ridderprint.nl)

© Tjitske Hielkema, 2017.

No parts of this thesis may be reproduced, stored or transmitted in any form or by any means without permission of the author or the publishers holding the copyright of the published articles.



rijksuniversiteit  
 groningen

# **Infants at very high risk of cerebral palsy**

- a challenging population -

## **Proefschrift**

ter verkrijging van de graad van doctor aan de  
 Rijksuniversiteit Groningen  
 op gezag van de  
 rector magnificus prof. dr. E. Sterken  
 en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op

woensdag 13 september 2017 om 16.15 uur

door

**Tjitske Hielkema**

geboren op 8 mei 1981  
 te Dokkum

**Promotores**

Prof. dr. M. Hadders-Algra

Prof. dr. J.H.B. Geertzen

**Beoordelingscommissie**

Prof. dr. J.G. Becher

Prof. dr. O.F. Brouwer

Prof. dr. P.U. Dijkstra

## **Paranimfen**

Amarins Hielkema

Rivka F. Toonen

## **TABLE OF CONTENTS**

### **Chapter 1**

Introduction

9

## **PART 1:**

### **Factors that may affect outcome in very high risk infants**

### **Chapter 2**

Motor and cognitive outcome after specific early lesions of the brain  
- a systematic review

29

### **Chapter 3**

Changes over time in contents of infant physiotherapy:  
a quantitative, observational study

45

## **PART 2:**

### **Early intervention in infants at very high risk of cerebral palsy**

### **Chapter 4**

Does physiotherapeutic intervention affect motor outcome in high-risk infants?  
An approach combining a randomized controlled trial and process evaluation

77

### **Chapter 5**

LEARN2MOVE 0-2 years: effects of a new intervention program in infants  
at very high risk for cerebral palsy; a randomized controlled trial

95

### **Chapter 6**

LEARN2MOVE 0-2 years: a randomized controlled trial on early intervention  
in infants at very high risk of cerebral palsy

111

**PART 3:**  
**Measuring gross motor function in young infants  
with or at very high risk of cerebral palsy**

**Chapter 7**

GMFM in infancy: age-specific limitations and adaptations 135

**Chapter 8**

Time to Update the Gross Motor Function Classification System (GMFCS)  
for Early Age Bands by Incorporation of Assisted Mobility? 155

**Chapter 9**

General discussion 161

Summary 181

Samenvatting 185

Dankwoord 191

Over de auteur 195

List of publications 197



