

University of Groningen

## Real-world influenza vaccine effectiveness

Darvishian, Maryam

**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:*

2016

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

*Citation for published version (APA):*

Darvishian, M. (2016). Real-world influenza vaccine effectiveness: New designs and methods to adjust for confounding and bias [Groningen]: University of 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).

**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.

# **Real-world influenza vaccine effectiveness**

New designs and methods  
to adjust for confounding and bias

Maryam Darvishian

## **Real-world influenza vaccine effectiveness**

New designs and methods to adjust for confounding and bias.

ISBN: 978-90-367-8942-4

ISBN Ebook: 978-90-367-8941-7

Printed by: Ridderprint BV, Ridderkerk, the Netherlands

Lay-out by: Ridderprint BV, Ridderkerk, the Netherlands

Cover design by: James Jardine ([www.jardinemedia.com](http://www.jardinemedia.com)); Maryam Darvishian

The printing of this thesis was financially supported by: University of Groningen, University Medical Center Groningen, Graduate School of Medical Sciences SHARE and Pfizer bv.

© Copyright M. Darvishian, Groningen 2016

All rights reserved. No part of this thesis may be reproduced, stored in a retrieval system, or transmitted in any other form or by any means, without the written permission from the author or, when appropriate, from the publishers of the publications.



rijksuniversiteit  
 groningen

# Real-world influenza vaccine effectiveness

New designs and methods  
to adjust for confounding and bias

PhD thesis

to obtain the degree of PhD at the  
University of Groningen  
on the authority of the  
Rector Magnificus Prof. E. Sterken  
and in accordance with  
the decision by the College of Deans.

This thesis will be defended in public on  
Tuesday 21 June 2016 at 11.00 hours

by

**Maryam Darvishian**  
born on 6 March 1983  
in Tehran, Iran

**Supervisors**

Prof. E. Hak  
Prof. E.R. van den Heuvel

**Assessment Committee**

Prof. T.J.M. Verhij  
Prof. G.H. de Bock  
Prof. A.L.W. Huckriede

**Paranymphs** Franklin Christiaan Karel Dolk  
Heng Liu



## TABLE OF CONTENTS

<b>Chapter 1.</b>	General introduction	9
<b>Chapter 2.</b>	After adjusting for bias in meta-analysis seasonal influenza vaccine remains effective in community-dwelling elderly <i>J Clin Epidemiol. 2014 Jul;67(7):734-44</i>	19
<b>Chapter 3.</b>	Effectiveness of seasonal influenza vaccine in community-dwelling elderly people: a meta-analysis of test-negative design case-control studies <i>Lancet Infect Dis. 2014;14(12):1228-39</i>	73
<b>Chapter 4.</b>	A generalized linear mixed model for meta-analysis of test-negative design case-control studies <i>Submitted for publication</i>	119
<b>Chapter 5.</b>	Influenza vaccine effectiveness among elderly population: evidence from individual participant data meta-analysis <i>In preparation for submission</i>	145
<b>Chapter 6.</b>	Influenza vaccine effectiveness in the Netherlands from 2003/2004 through 2013/2014: the importance of circulating influenza virus types and subtypes <i>Under review</i>	177
<b>Chapter 7.</b>	Influenza vaccine effectiveness estimates in the Dutch population from 2003 to 2014: the test-negative design case-control study with different control groups <i>Under review</i>	199
<b>Chapter 8.</b>	General discussion	221
<b>Chapter 9.</b>	Summary	239
	Nederlandse samenvatting	245
	Acknowledgement	249
	About the author	253
	Other SHARE dissertations	255