

**FUNDAL HEIGHT MEASUREMENTS: THE STANDARD
NORMAL CURVE DEVELOPMENT, SUBGROUP-
SPECIFIC CURVES AND SCREENING
APPLICATION**

JIRAWAN DEELUEA

**DOCTOR OF PHILOSOPHY
IN CLINICAL EPIDEMIOLOGY**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

**GRADUATE SCHOOL
CHIANG MAI UNIVERSITY
MAY 2017**

**FUNDAL HEIGHT MEASUREMENTS: THE STANDARD NORMAL
CURVE DEVELOPMENT, SUBGROUP-
SPECIFIC CURVES AND SCREENING
APPLICATION**

JIRAWAN DEELUEA

**A THESIS SUBMITTED TO CHIANG MAI UNIVERSITY IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN CLINICAL EPIDEMIOLOGY**

ลิขสิทธิ์ © by Chiang Mai University
All rights reserved

**GRADUATE SCHOOL, CHIANG MAI UNIVERSITY
MAY 2017**

**FUNDAL HEIGHT MEASUREMENTS: THE STANDARD NORMAL
CURVE DEVELOPMENT, SUBGROUP-SPECIFIC CURVES AND
SCREENING APPLICATION**

JIRAWAN DEELUEA

THIS THESIS HAS BEEN APPROVED TO BE A PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN CLINICAL EPIDEMIOLOGY

Examination Committee:

Ounjai Kor-anantakul Chairman
(Prof. Ounjai Kor-anantakul, M.D.)

Theera Tongsong Member
(Prof. Theera Tongsong, M.D.)

Chidchanok Ruengorn Member
(Dr. Chidchanok Ruengorn)

Supatra Sirichotiyakul Member
(Assoc. Prof. Supatra Sirichotiyakul, M.D.)

S. Namwongprom Member
(Assoc. Prof. Dr. Sirianong Namwongprom, M.D.)

Sawaek Weerakiet Member
(Prof. Sawaek Weerakiet, M.D.)

Advisory Committee:

Supatra Sirichotiyakul Advisor
(Assoc. Prof. Supatra Sirichotiyakul, M.D.)

S. Namwongprom Co-advisor
(Assoc. Prof. Dr. Sirianong Namwongprom, M.D.)

Sawaek Weerakiet Co-advisor
(Prof. Sawaek Weerakiet, M.D.)

26 May 2017

Copyright © by Chiang Mai University

**This dissertation is dedicated to my family,
friends and colleagues.**



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

ACKNOWLEDGEMENTS

I would like to express my gratefulness to my major advisor Assoc. Prof. Supatra Sirichotiyakul for her patient guidance, enthusiastic encouragement, and useful critiques throughout the doctoral program. Moreover, my great appreciation goes to my co-advisors, Prof. Sawaek Weerakiet, and Assoc. Prof. Dr. Sirianong Namwongprom for their invaluable knowledge, insightful comments and kindness. I would like to express my great appreciation to Prof. Dr. Jayanton Patumanond for his valuable and constructive suggestions in research methods, statistical analysis and publication along the way.

Special thanks go to Asst. Prof. Dr. Tanyong Pipanmekaporn for friendship and assistance. I am thankful to Ms. Phakjira Jaiman for her help in English correction in this thesis. Special thanks to Ms. Chamainat Khongdarm, a third year nursing student for the well-illustrated Figures in chapter 2.

Lastly, I would like to express my appreciation to my friends, colleagues and my family members for providing support and everything I needed to successfully complete my thesis.

The studies in this thesis and publication fees were totally funded by The Faculty of Medicine, Chiang Mai University.

Permission for reproduction was attained from The Editorial Office of ISRN Obstetrics and Gynecology from Hindawi Publishing Corporation (studies I and II) and the Editorial Office of Risk Management and Healthcare Policy from Dove Medical Press (study III).

Jirawan Deeluea