

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**Performance measures, reimbursement and  
behaviour of public health care providers in New  
Zealand**

A thesis presented in partial fulfillment of the requirements for the degree

Doctor of Philosophy

at

School of Economics and Finance

Massey University, Albany

Somi Shin

2013

## **Abstract**

This dissertation contains three empirical studies that examine the performance measures, reimbursement and behaviour of New Zealand public health care providers, the district health boards (DHBs).

The first essay investigates whether highly skilled health care providers are at a disadvantage because they attract difficult cases, by examining over 10 million publicly funded patient discharges in New Zealand during the period from 1999 to 2011. Using a patient's transfer status and the complexity and comorbidity level (CCL) indicator as the measure of task difficulty, I calculate the effects of task difficulty on performance indicators such as the length of hospital stay, and the probabilities of 30-day mortality and readmission while controlling for potential endogeneity. The results confirm that this disadvantage does exist. Transferred patients stay in hospital longer, and have higher probabilities of 30-day mortality and 30-day readmission. Overall, patients assigned to higher level of complexity and comorbidity indicators also have longer hospital stays and higher probabilities of mortality and readmission.

The second essay examines how the public health care providers in New Zealand responded to the system reform that reintroduced a capitation scheme, which pays providers a fixed amount per enrollee, regardless of the actual service usage per enrollee. I find that the new capitation scheme decreased the movement of patients between districts, especially those whose conditions are more severe. The results indicate that sicker patients are less likely to be treated by specialist providers since the reform. Overall, the decrease in inter-district movement seems to have negative effects on health outcomes.

The third essay examines the capitation funding system for New Zealand public health care providers, which allocates funds across districts based on the characteristics of district population. As the first step in understanding the adequacy of this payment system, this research examines how the actual usage by patients is associated with the funding, which is computed based on the characteristics of population. To examine the relation, I regress the government funding received by the DHBs on the characteristics of the population who actually received treatment over the period of 2003 to 2011. I find that the usage of health care services by certain population groups is higher than their population share.

## **Acknowledgements**

I would like to thank Professor Christoph Schumacher for being a great supervisor. He encouraged me to undertake PhD study and offered support, guidance and friendship throughout the journey. I am also grateful to Dr. Lorenzo Ductor for his advice and knowledge. He offered me tremendous help and insightful suggestions not only for my PhD study but also for the research in general and job search. My sincere thanks go to Dr. Peren Arin, who I have had the pleasure to meet and work with before he left Massey. His kind encouragement and advice are greatly appreciated.

My special thanks also go out to the staff in the School of Economics and Finance who have been very helpful and supportive. The general staff (Sharon, Cath, Rochelle, Liz and Mary) have always made me and the other PhD students feel at home. I appreciate participants at the brown bag seminars and the New Zealand Hospital Tertiary Services National Conference for their valuable comments. I was lucky to have amazing PhD students around me to share the ups and downs during the time of my study. I would like to thank Cherry, Christo and Annie, in particular, for making the time much more enjoyable and, most of all, for their friendship.

This PhD would not have been achievable without the love, support and encouragement from my family. My endless love and thanks go to Mom and Dad, who know all too well from their own experiences how lengthy and difficult the process of PhD can be. They have always been there for me and offered kind and loving encouragement when I was going through a rough patch. My sister, Dongmi, has been a wonderful friend I can talk to for hours at times (I am sorry about the phone bill debacle!) and made me laugh so much. Last but not least, my beloved other half, Jeff,

has been the most understanding husband anyone could ever ask for. I am grateful to him for showing me that there is much more to life than what I know.

I dedicate this dissertation to Mom, Dad, my sister and Jeff.

# Table of Contents

<b>Abstract .....</b>	<b>i</b>
<b>Acknowledgements .....</b>	<b>iii</b>
<b>List of Tables.....</b>	<b>ix</b>
<b>List of Figures .....</b>	<b>xi</b>
<b>Chapter 1 Introduction .....</b>	<b>12</b>
<b>1.1 Introduction .....</b>	<b>12</b>
<b>1.2 Contribution to the literature.....</b>	<b>14</b>
1.2.1 Expertise: Is it a gift or curse? Evidence from the health care sector.....	15
1.2.2 Health care provider response to system reform: Effects of capitation on the inter-district movement of patients and health outcomes .....	16
1.2.3 Public health care provider reimbursement in New Zealand .....	17
<b>1.3 Organisation of dissertation .....</b>	<b>19</b>
<b>Chapter 2 Expertise: Is it a gift or a curse? Evidence from the health care sector .....</b>	<b>20</b>
<b>2.1 Introduction .....</b>	<b>20</b>
<b>2.2 Related literature.....</b>	<b>24</b>
<b>2.3 Data.....</b>	<b>29</b>
<b>2.4 Methodology.....</b>	<b>34</b>
<b>2.5 Empirical results.....</b>	<b>39</b>
<b>2.6 Robustness checks .....</b>	<b>43</b>

2.6.1 DRG codes .....	43
2.6.2 Adult services and pediatrics.....	47
<b>2.7 Conclusion.....</b>	<b>50</b>
<b>Chapter 3 Health care provider response to system reform: Effects of capitation on the inter-district movement of patients and health outcomes.....</b>	<b>51</b>
<b>3.1 Introduction .....</b>	<b>51</b>
<b>3.2 Background and related Literature.....</b>	<b>59</b>
3.2.1 Background .....	59
3.2.2 Related literature .....	63
<b>3.3 Data.....</b>	<b>69</b>
<b>3.4 Methodology.....</b>	<b>77</b>
<b>3.5 Results.....</b>	<b>81</b>
3.5.1 Effects of the system reform on providers of different skills .....	82
3.5.2 Effects of the system reform on complex cases .....	86
3.5.3 Effects of the system reform on health outcomes .....	89
<b>3.6 Robustness checks .....</b>	<b>94</b>
3.6.1 Analysis of the subset.....	94
3.6.2 Effects of readmission on mortality .....	97
<b>3.7 Conclusion.....</b>	<b>99</b>
<b>Chapter 4 Public health care provider reimbursement in New Zealand.....</b>	<b>102</b>
<b>4.1 Introduction .....</b>	<b>102</b>

<b>4.2 Background and related literature .....</b>	<b>106</b>
4.2.1 Health care payment system in New Zealand .....	106
4.2.2 Related literature .....	109
<b>4.3 Data and methodology .....</b>	<b>115</b>
4.3.1 Data .....	115
4.3.2 Methodology .....	117
<b>4.4 Regression results .....</b>	<b>124</b>
<b>4.5 Conclusion .....</b>	<b>134</b>
<b>Chapter 5 Conclusions .....</b>	<b>137</b>
<b>References .....</b>	<b>141</b>

## List of Tables

Table 2.1 Major Diagnostic Category (MDC) .....	31
Table 2.2 Descriptive statistics.....	32
Table 2.3 Summary statistics by MDC .....	36
Table 2.4 First stage regressions (Dependent variable: Transfer).....	40
Table 2.5 Effects of transfer and CCL on length of stay ( $N=10,728,729^a$ ) .....	41
Table 2.6 Effects of transfer and CCL on mortality ( $N=10,625,264^a$ ).....	42
Table 2.7 Effects of transfer and CCL on readmission ( $N=10,310,999^a$ ).....	43
Table 2.8 Effects of complexity on length of stay after controlling for DRG ( $N=2,145,746$ ).....	44
Table 2.9 Effects of complexity on mortality after controlling for DRG.....	45
Table 2.10 Effects of complexity on readmission after controlling for DRG.....	46
Table 2.11 Adult services and pediatrics: Length of stay .....	48
Table 2.12 Adult services and pediatrics: 30-day mortality.....	49
Table 2.13 Adult services and pediatrics: 30-day readmission.....	49
Table 3.1 DHB funding and population share (%), 2003/2004.....	61
Table 3.2 Descriptive statistics for inter-district flows and transfer by skill level ( $N=10,777,536$ ) .....	63
Table 3.3 Descriptive statistics for CCL ( $N=10,776,648$ ) .....	71
Table 3.4 Descriptive statistics.....	75
Table 3.5 Effects of capitation on patient flow ( $N=10,776,648$ ) .....	83
Table 3.6 Effects of mortality on transfer ( $N=10,624,264$ ) .....	89
Table 3.7 Effects of capitation on health outcomes .....	91
Table 3.8 Effects of capitation on patient flow since 2001 ( $N=9,223,433$ ).....	95
Table 3.9 Effects of mortality on transfer ( $N=10,625,264$ ) .....	98
Table 4.1 Direction of transfer .....	118

Table 4.2 Descriptive statistics ( $N=168$ ).....	121
Table 4.3 Effects of case complexity on funding per case.....	127
Table 4.4 Correlations among key variables.....	132
Table 4.5 First stage regressions.....	133

## List of Figures

Figure 3.1 Differences in the annual funding growth rates between each DHB and the average across DHBs (Mean of differences over 2001-2011 period).....	62
Figure 3.2 Proportion of IDFs received by skill level.....	73
Figure 3.3 Proportion of inter-district transfer sent by skill level.....	73
Figure 3.4 Pattern of coefficients for the interaction terms <sup>i</sup> .....	93