

**THE IMPACT OF HOME HEALTH AGENCY PROFIT ORIENTATION AND
POST-ACUTE CARE MARKET COMPETITION ON PATIENT RISK FOR
REHOSPITALIZATION**

BY

LAURA M. SMITH

B.S., UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL, 1995

A.M., BROWN UNIVERSITY, 2007

ADVISOR

VINCENT MOR, PH.D.

BROWN UNIVERSITY

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY
IN THE PROGRAM IN EPIDEMIOLOGY IN THE DIVISION OF BIOLOGY AND MEDICINE
AT BROWN UNIVERSITY

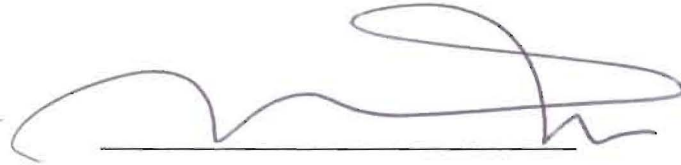
PROVIDENCE, RHODE ISLAND

MAY 2009

© Copyright 2009 by Laura M. Smith

This dissertation by Laura Margaret Smith is accepted in its present form
by the Department of Community Health as satisfying the
dissertation requirement for the degree of Doctor of Philosophy.

Date 10-12-08



Vincent Mor, PhD, Advisor

Recommended to the Graduate Council

Date 10/12/08



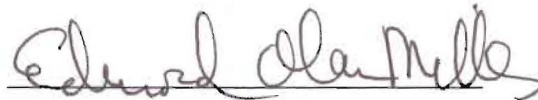
Kate Lapane, PhD, Reader

Date 10/12/08



Mary Fennell, PhD, Reader

Date 10/12/08



Edward Alan Miller, PhD, MPA, Reader

Approved by the Graduate Council

Date _____

Sheila Bonde, Dean of the Graduate School

CURRICULUM VITAE

LAURA M. SMITH

Department of Community Health, Brown University, Box G-S121, Providence RI 02912

401-699-4582 (mobile), laursmi@gmail.com

Date of birth: September 23, 1973; Place of birth: Summit, NJ

Education

Brown University, Department of Community Health, Providence, RI

PhD, Epidemiology - Health Services Policy and Practice Section 2009

Committee: Vincent Mor, Kate Lapane, Mary Fennell, and Edward Alan Miller

Master of Arts, Epidemiology - Health Services Policy and Practice Section 2007

University of North Carolina at Chapel Hill, Chapel Hill, NC

Bachelor of Science, Biology (Distinction) and English (Honors) 1995

Grants and Awards

AHRQ Health Services Research Dissertation Grant #1R36HS017382-01 (R36) 2007-2008

Participant, RAND Summer Institute 2007

National Institute on Aging Training Grant Fellowship #AG023482-02 (T32) 2005-2007

Spatial Structures in the Social Sciences (S4) Graduate Fellow, Brown University 2006-2007

Teaching Certificate I, Harriet W. Sheridan Center for Teaching and Learning, Brown 2006

Phi Beta Kappa 1995

University Teaching Experience

Brown University, Department of Community Health, Brown University, Providence, RI

Teaching Assistantships:

- *Introduction to Methods in Epidemiologic Research* - Instructor: Sally Zierler Fall 2005

Guest Lecture: 'Measurement of Random Error,' November 2005

- *Health and Society* - Instructor: Vincent Mor Spring 2004, 2005
Guest Lectures: 'Mental Health Services in the United States'; 'Federal and State Policy Conflicts,'
- *The Burden of Disease in Developing Countries* - Instructor: Stephen McGarvey Fall 2004
- *Introduction to Public Health* - Instructor: Melissa Clark, Fall 2003

Research Experience

Brown University, Center for Gerontology and Health Care Research, Providence, RI

Graduate Research Assistant

- *JEHT Foundation Policy Research and Advocacy Grant in Palliative Care* 2006-2007
Mentors: Susan Miller, and Renee Shield
- *Georgia Nursing Homes Project* (<http://www.s4.brown.edu/GNH/index.html>) 2004-2005
Mentors: John Logan and Vincent Mor
- *National Commission for Quality Long Term Care* 2004
Mentors: Edward Alan Miller and Vincent Mor

University of North Carolina at Chapel Hill, Sheps Center for Health Services Research

Research Associate (2001-2003) North Carolina Health Professions Data System

- Conducted descriptive analyses of health workforce data; developed, wrote, and revised publications and presentations. Maintained and developed relationships with outside stakeholders. Assisted with project management, proposal preparation, and supervision of a student research assistant
Supervisor: Thomas C. Ricketts, PhD

Research Assistant (1999-2001) North Carolina Health Professions Data System

- Supervisor: Thomas C. Ricketts, PhD

Peer-Reviewed Papers

Smith LM, Lapane KL, Fennell ML, Miller EA, Mor V. Home health agency profit orientation and risk for hospitalization: a propensity score analysis of population weighted data. Currently under review: *Home Health Care Services Quarterly*. 2008; 27(3):240-257.

Fraher EP, Slifkin RT, **Smith LM**, et. al. How Might the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 Affect the Financial Viability of Rural Pharmacies? An Analysis of Preimplementation Prescription Volume and Payment Sources in Rural and Urban Areas. *The Journal of Rural Health*.2005;21(2):114-21.

Posters and Presentations

Smith LM, Lapane KL, Fennell ML, Miller EA, Mor V. The impact of home health agency profit status on risk for hospital readmission among post-acute care Medicare home health beneficiaries. Poster. AcademyHealth Annual Meeting. June 2008.

Smith LM, Miller SC, Lima J, Shield R, Booth M. How Are State Regulations, Medicaid Policies and Managed Care Programs Associated with Access to Palliative Care/Hospice? Symposium Presentation, Gerontological Society of America Annual Meeting. Nov 2007.

Smith LM, Mor V. Demographic, clinical and treatment differences among home health agency patients referred to agency care by hospital or from the community. Poster, Gerontological Society of America Annual Meeting. Nov 2007.

Smith LM, Mor V. A comparison of risk for hospitalization among black and white users of home health care. Poster, AcademyHealth Annual Meeting. June 2007.

Smith LM. Racial disparities in access to quality nursing home care: Does distance matter? Invited presentation, Spatial Structures in the Social Sciences Winter GIS Institute. January 2007.

Smith LM, Mor V. Race and Geography: disparities in choice and access to nursing homes. Poster, Gerontological Society of America Annual Meeting. Nov 2006.

Smith LM, Allen SM. State Variation in Public Financing of Behavioral Health Services and Risk for Unmet Need for Mental Health Services in Children with Special Needs. Poster, AcademyHealth Annual Meeting. June 2006.

Smith LM. Why Online Interactive Mapping? The Georgia Nursing Homes Project. Invited presentation, Spatial Structures in the Social Sciences Summer GIS Institute. June 2006.

Smith LM. Racial disparities in access to quality nursing home care: Does distance matter? Presentation, Spatial Structures in the Social Sciences Summer GIS Institute. June 2006.

Fraher EP, **Smith LM**, Ricketts TC. Addressing Allied Health Workforce Shortages: A Successful AHEC Collaboration. Presentation, National AHEC Organization Workshop, Little Rock, AR. April 2002.

Ricketts TC, **Smith LM.** North Carolina Health Care Data: The North Carolina Health Professions Data System. Presentation, The University of North Carolina Board of Governors. Chapel Hill, NC. November 2001.

Fraher EP, **Smith LM**, Newton M, and Mullins J. The Speech-Language Pathology Workforce in North Carolina: Findings of the Technical Panel on the Speech-Language Pathology Workforce. Presentation, Council for Allied Health in North Carolina. Cary, NC. March 2001.

Ricketts TC, **Smith LM.** North Carolina Health Care Data. Presentation, The University of North Carolina Board of Governors. Chapel Hill, NC. November 2000.

Smith LM. Radiologic Technologist Workforce Assessment Project. Presentation, North Carolina Radiologic Technologist Society. Burlington, NC. September 2000.

Book Chapter

Baer LD and **Smith LM.** 'Nonphysician Professionals and Rural America.' In TC Ricketts (ed.), *Rural Health in the United States* (pp. 52-60). New York: Oxford University Press, 1999.

Technical Reports

Miller SC, Shield R, Mor V, Teno J, Lima J, **Smith L**, Grossman N, Booth, M *Palliative Care/Hospice For Persons With Terminal and/or Chronic Progressive Illness: The Role of State and Federal Policies in Shaping Access and Quality for Persons Receiving Long-Term Care* Center for Gerontology And

Health Care Research, Department of Community Health, The Warren Alpert Medical School of Brown University, July 2007.

Smith LM, Higginbotham S, Fraher EP, et. al. *A Special Report on Health Manpower: Health Professions 2002 Data Book*. NC Health Professions Data System. August 2003.

Dyson S, Fraher EP, and **Smith LM**. The Health Information Management Workforce in North Carolina: Current Trends, Future Directions. A Report of the Technical Panel on the Health Information Management Workforce, Council for Allied Health in North Carolina. October 2002.

Higginbotham S, **Smith LM**, Fraher EP, et. al. *A Special Report on Health Manpower: Health Professions 2001 Data Book*. NC Health Professions Data System. October 2002.

Fraher EP, **Smith LM**, Dyson S, Ricketts TC. The Pharmacist Workforce in North Carolina. NC Health Professions Data and Analysis System. September 2002.

Smith LM, Marshall A, Fraher EP, et. al. A Special Report on Health Care Resources in North Carolina: North Carolina Health Professions 2000 Data Book. NC Health Professions Data System. March 2002.

Fraher EP, **Smith LM**, et. al. Will There Be Jobs? Employment Prospects for the Speech Language Pathology Workforce. A Report of the Technical and Advisory Panels on the Speech Language Pathology Workforce. June 2001.

Smith LM, Fraher EP, Hadley HL, et. al. A Special Report on Health Care Resources in North Carolina: North Carolina Health Professions 1999 Data Book. NC Health Professions Data System. March 2001.

Smith LM, Fraher EP, Pirani MJ, et. al. A Twenty-Year Profile of Trends in Licensed Health Professions in North Carolina: 1979-1998. NC Health Professions Data System. October 2000.

Smith LM, Pirani MJ, Hadley HL, et. al. A Special Report on Health Manpower: North Carolina Health Professions 1998 Data Book. NC Health Professions Data System. August 1999.

PREFACE

A dissertation in the Department of Community Health takes the form of three publishable papers (Chapters 1 through 3). This document was re-formatted to comply with the Graduate School requirements at Brown University.

Findings from the study described in Chapter 1 have been published in the Fall, 2008 issue of the *Home Health Care Services Quarterly*. Preliminary results from Chapter 2 were selected for a poster presentation at the AcademyHealth Annual Meeting,. June 2008.

ACKNOWLEDGEMENTS

There are several people whose support was vital to the completion of this dissertation. First I would like to thank the members of my dissertation committee. I would like to thank Vincent Mor for serving as my dissertation chair. I cannot value enough your continual enthusiasm and support during the dissertation process that helped keep me energized and focused. To Kate Lapane, it has been a true privilege to have you as a member of my committee, as a professor and as a mentor. Your influence on me as a researcher has been profound and I am deeply grateful to have had your guidance throughout my graduate experience. Thank you to Eddie Miller for your incisive questions and in particular your detailed attention to my written work. Your insight has been invaluable in assuring my work translates to the multidisciplinary audience that makes up the field of health services research. I would also like to thank Mary Fennell, who served on my committee, but who I am indebted to for being my advisor for a reading course in organizational sociology that was pivotal to my thinking about the content and focus of my dissertation. Thank you in particular during my dissertation process for helping me to understand how my research fits into the broader context of research on organizational behavior.

In addition to my committee, I would like to thank other individuals whose assistance was vital to this dissertation. Barbara Gage and Jacqueline Zinn served as outside readers and provided valuable feedback and encouragement. David Radley provided generous and timely assistance obtaining key data elements for my third paper. I would also like to thank Zhanlian Feng for letting me bounce questions off of him about

STATA and suggesting strategies to increase the efficiency of my data analyses. Jeffrey Hiris's insights into data management were also invaluable.

I would also like to acknowledge others who I have been lucky enough to shape my thinking and the path that I have taken. Thank you to Susan Miller for providing a wonderful role model for what I would like to be as a researcher. I appreciate the opportunities that you gave me to grow as a professional. To Sally Zierler thank you for challenging me to be aware of, acknowledge and own my own thinking and assumptions as a scientist. I also must thank Erin Fraher who, as my supervisor prior to my entering graduate school, not only set an example for me as a manager and researcher, our discussions about quality improvement and management laid the foundation for my interest in organizational behaviour and its relationship to patient outcomes.

Last but certainly not least, I must thank my friends and my family for their support. I thank in particular Karen Schneider, Andrea Gruneir and Jessica Jalbert for their good humor, unwavering support, and excellent insight as Epidemiologists and as human beings. I could not have gotten luckier to have had you as my classmates and as my friends. Thank you to Jennifer Christian for founding the Dissertation Writer's Group, I am grateful to have had the benefit of this great resource made up of the fine minds, and good hearts of Christen O'Haire, Julia Dibello, Molly Waring, Tianli Liu and Susan Wieland. To Rosa Baier, thank you for getting me to the gym or out into the world for a walk, for exercise and good conversation and for making me laugh. Thank you to Chris Magdalenski who kept me connected with encouraging phone calls, made sure I was fed, and made sure that I did not lose touch with myself. And most of all, thank you to Lon

and Lucy Smith (a.k.a. Mom and Dad), thank you for always being there at the other end of the line with love, pride and understanding at any hour.

TABLE OF CONTENTS

SIGNATURE PAGE	iii
CURRICULUM VITAE	iv
PREFACE	ix
ACKNOWLEDGEMENTS	x
TABLE OF CONTENTS	xiii
LIST OF TABLES	xv
CHAPTER 1: Home health agency profit orientation and risk for hospitalization: a propensity score analysis of population weighted data.....	2
ABSTRACT	3
INTRODUCTION	3
METHODS	6
RESULTS	11
DISCUSSION	13
TABLES	18
CHAPTER 2: The Impact of Home Health Agency Profit Status on Risk for Hospital Readmission Among Post-Acute Care Medicare Home Health Beneficiaries	22
ABSTRACT	23
INTRODUCTION	25
METHODS	27
RESULTS	34
DISCUSSION	36

TABLES	44
TABLES	44
CHAPTER 3: The Impact of Home Health Agency Market Competition on Risk for	
Hospital Readmission Among Post-Acute Care Medicare Home Health Beneficiaries ..	
53	
ABSTRACT.....	54
INTRODUCTION	55
THEORY AND HYPOTHESES	55
METHODS	59
RESULTS	71
DISCUSSION.....	73
TABLES	79
REFERENCES	99

LIST OF TABLES

Chapter 1

Table 1.1:	Patient Demographic Characteristics by HHA Profit Orientation	18
Table 1.2:	Patient Clinical Characteristics by HHA Profit Orientation	19
Table 1.3:	Patient Distribution by HHA Characteristics, by HHA Profit Orientation..	20
Table 1.4:	Adjusted Estimates for Association Between Profit Orientation and Hospitalization, Death or Other Inpatient Admission.....	21

Chapter 2

Table 2.1:	Agency Characteristics by Profit Orientation	44
Table 2.2:	Length of Service, Living Arrangements, Non-agency Assistance Available, and Functional Status by HHA Profit Orientation	45
Table 2.3:	Clinical Characteristics, by HHA Profit Orientation	47
Table 2.4:	Crude and Adjusted Estimates of Association Between HHA Profit Orientation and Rehospitalization.....	50

Chapter 3

Table 3.1a:	Market Characteristics by Market Level of HHA Competition.....	79
Table 3.1c:	Patient Characteristics by Market Level of HHA Competition	83
Table 3.2:	Crude Estimates of Association Between Market Competition and Rehospitalization.....	87
Table 3.3:	Adjusted Estimates of Association Between Market Competition and Rehospitalization.....	93

Table 3.4:	Adjusted Estimates of Association Between Profit Orientation and Rehospitalization by Market Competition, Parsimonious Model plus Variables of Interest.....	95
Table 3.5:	Adjusted Estimates of Association Between Profit Orientation and Rehospitalization Stratified by Market Competition	97

**CHAPTER 1: Home health agency profit orientation and risk for
hospitalization: a propensity score analysis of population weighted data**

ABSTRACT

Little recent research exists identifying home health agency (HHA) organizational characteristics that influence home health quality. This study evaluates the impact of HHA profit orientation on quality, measured as patient risk for hospitalization within 60 days of agency admission. Our sample (n=1304), from the National Home and Hospice Care Survey, comprised non-institutionalized patients, 18 and older, including all payer types, discharged from free-standing HHA. Our most deconfounded estimate, derived by propensity score adjusted, weighted polytomous logistic regression, yielded a for-profit hospitalization odds ratio of 1.31 but with a large confidence interval including unity. Results do not support our hypothesis of higher hospitalization risk for for-profit HHA patients.

Key Words: Home health, home health care agencies, ownership, hospitalization, quality

INTRODUCTION

Home health agencies (HHAs) are an increasingly important provider of skilled and post-acute care services in the United States. The number of HHAs reported by the Medicare Payment Advisory Commission increased 17% from 6,888 in 2002 to 8,082 in 2005¹ and personal health care expenditures for home health have also increased, from \$12.6 billion to \$40 billion between 1990 and 2003, or from 2.0% to 2.8% of total personal health expenditures². While increased utilization and availability of home health care are consistent with federal and state policy directions emphasizing provision of health care in the least restrictive setting possible, including rebalancing the focus of

long-term care from institutional to non-institutional settings, the annual rate of hospital admissions for HHA patients remains high, at 28%¹.

Hospitalization rates have been used as indicators of health care quality in other settings including nursing homes³. Hospitalization increases risks for adverse health outcomes, adds to system costs, and is distressing, particularly for older patients⁴. Though some hospitalizations are necessary and may be a sign of good quality care, prior research suggests quality HHA care can reduce hospitalization⁵. Recognizing this, CMS reports acute care hospitalization as a quality indicator on Medicare's Home Health Compare website. This indicator has been targeted for a nation-wide home health care quality improvement campaign⁶.

Little recent research exists identifying HHA organizational characteristics that influence home health quality⁷. Studies of other health sectors have found profit status is a salient characteristic, with for-profits generally faring more poorly on patient care quality measures⁸⁻¹⁰. We grounded the current study in organizational theory, focusing on differences in organizational goals, as represented by agency profit orientation, and hypothesized for-profit HHAs would provide poorer quality care, measured here as hospitalizations occurring within 60 days of admission to agency care. This study adds to the literature by using competing risk methods to evaluate risk for hospitalization, given the possibility of multiple types of adverse outcomes (hospitalization, death, and admission to nursing home or other type of institution). This analysis also explicitly seeks, using propensity score estimation, to control for confounding that may have been introduced by differential sorting of patients into for-profit and not-for-profit HHA care. Estimates from this analysis are based on a nationally representative sample of home

health agency patients, which includes patients with all payer types (i.e., Medicare, Medicaid, out-of-pocket, and private insurance).

Profit Orientation and Quality

While the association between profit status and quality has been extensively reviewed in other health care sectors, the literature looking at this relationship among HHAs is lacking¹¹⁻¹⁴. Resource dependency theory explains organizational and managerial behavior as a response to environmental uncertainty, where organizations position themselves to better acquire and maintain supplies of resources^{15, 16}. Organizational behavior is therefore influenced by the priorities of key resource suppliers¹⁷: for-profits maximize profit to meet the interests of share-holders¹⁸; not-for-profits must satisfy mandates, including provision of unprofitable services and charity care, imposed from community and government interests, in exchange for their tax status^{19, 20}. One would then expect differences in the behavior of for-profit and not-for-profit health care entities, with possible implications for health care quality. Given this logic, for-profits are generally perceived to be more efficient, or better able to provide a set of services at a minimum cost, than not-for-profits⁸. Of concern, however, is when pursuit of profits might come at the cost of quality patient care. In the case of for-profit HHAs, agencies might increase patient volume while reducing visits per episode and visit lengths to increase revenue, putting patients at risk for poorer quality care. When reimbursement is fixed and few penalties exist for hospitalization, agencies may also have an incentive to discharge costly patients to inpatient settings and may discourage service contracts with high-need patients.

In 2000, 49% of all Medicare certified HHA (freestanding and facility-based) were proprietary²¹, serving approximately 34% of all Medicare Home Health beneficiaries²². Studies comparing for-profit and not-for-profit HHAs have focused on process measures, costs, and changes in agency behavior in response to policy changes, particularly the implementation of home health prospective payment (PPS), which potentially created incentives for HHAs to reduce services. Studies of HHA behavior prior to full HHA PPS implementation found for-profit agencies had more visits per case^{13, 16, 23}, higher costs and revenues^{13, 16} and used more contract and part-time staff^{13, 23}. Following PPS implementation, for-profit agencies had proportionately larger reductions in median length of service²⁴. They also reduced visits per patient more strongly than not-for-profits²⁵. Additionally, more for-profits left the home health market¹.

METHODS

Data and Sample

This analysis used the 2000 National Home and Hospice Care Survey (NHHCS), the most recent wave available of the nationally representative survey conducted by the National Center for Health Statistics. Details regarding the design of the NHHCS are available elsewhere²⁶. The current study used the discharge patient file (n= 6,273) focusing on the 3,946 records for patients receiving home health or home care services. Discharges are weighted to represent all discharges occurring from October 1999 through September 2000²⁶.

The final analysis file contained data for discharges of non-institutionalized individuals eighteen years old and older, excluding those with any pregnancy related

diagnosis⁴ and those individuals referred to agency care by a nursing home or hospice agency. We included only those individuals with a length of service no longer than two years²⁷ to minimize the risk of confounding by changes in policy, and clinical or administrative practice.

Because the NHHCS does not distinguish patients who are receiving home health care from those receiving only home care, we focused only on individuals receiving care from agencies certified as a HHA by Medicare or Medicaid. Individuals receiving care from government HHAs were also excluded because government HHAs are likely organizationally different than for-profit and not-for-profit agencies and the category was too small to assess separately¹⁴. The final study sample comprised 1304 individuals, representing a population of 2,196,515 home health patients.

Outcomes

Conceptually the proposed study seeks to quantify occurrences of poor quality HHA care, measured here as hospitalization occurring within 60 days of admission to agency care, controlling for individual patient risk factors. Over 80% of home health care discharges in the NHHCS occur within 60 days of admission²⁷, an interval corresponding to a Medicare home health reimbursement ‘episode’. A polytomous outcome was used to account for competing risks for death and discharge to alternate inpatient settings. Discharge reasons were categorized as follows: 1. hospitalization, 2. death, 3. admission to nursing home or other inpatient facility, 4. neutral or positive discharge or censored (referent outcome). Discharge status was evaluated for individuals with a length of service equaling 60 days or less. The referent outcome comprises individuals with potentially positive discharge dispositions including recovered, or stabilized; or neutral

discharge dispositions including family resuming care. Individuals with no transfer or discharge within 60 days were censored and, likewise, included in the referent outcome. While hospitalization, death and discharge to another inpatient facility should have relatively little measurement error, we did not differentiate positive from neutral outcomes due to the potential for misclassification.

Exposure

For the current study, profit orientation was operationalized as a dichotomous variable: for-profit and not-for-profit based on agency self-report. As mentioned earlier, agencies identified as state-, local-, federal- or other government were not included in the analysis.

Potential Confounders

We reviewed the literature to identify potential independent risk factors for hospitalization that might be confounders in the current study. Those identified include patient demographics: age, gender, race²⁸, marital status²⁹, and availability of a primary caregiver^{28, 29}.

We also considered clinical and agency characteristics. Two approaches to measuring the burden of patient comorbidities were used. We assigned a categorized Charlson comorbidity score (levels: 0, 1, 2, 3 or more), created using the original Charlson score index weights^{30, 31} based on patients' six listed HHA admission diagnoses. For the second approach, variables indicate the occurrence, in any listed diagnosis, of each of four major comorbidities associated with home health care: congestive heart failure, chronic obstructive pulmonary disease, diabetes and cancer²⁴. Functional status was characterized by creating counts (levels: 0, 1, 2 or more) of ADL and IADL deficiencies based on

NHHCS variables indicating need for assistance in six ADLs and six IADLs²⁴. We also included aids used and presence of urinary catheter or colostomy at admission, and source of referral to home care^{32, 33}. We constructed a summary variable combining primary and secondary payer source³⁴, identifying individuals with Medicare and no Medicaid, those with Medicaid and no Medicare, those eligible for both, and those with only private sources of payment³⁵. Agency organizational characteristics including chain membership, size, census region, and urban or rural location were also evaluated³⁶.

Statistical Analyses

All analyses were conducted using SAS-callable SUDAAN version 9.0.0 (Research Triangle Institute, Research Triangle Park, NC) at the National Center for Health Statistic's Research Data Center to access survey design variables and weights necessary for proper estimation of standard errors. Bivariate comparisons were conducted to evaluate the potential for confounding by individual, agency and geographic characteristics discussed above.

Multivariable Analysis

We used polytomous multiple logistic regression modelling to estimate adjusted odds ratios³⁷ comparing by profit orientation, the occurrence of hospitalization, death, or nursing home admission within 60 days, relative to the occurrence of the neutral or positive discharge outcome. First, a crude analysis was conducted, then potential confounders evaluated in an iterative process. Each variable was introduced individually into the model and its impact on the estimate of the effect of profit orientation on hospitalization assessed. Variables changing the hospitalization estimate by more than ten percent were considered confounders and kept in the final model. We also ran a full

model including all potential confounders to evaluate the possibility of additional residual weak confounding by variables not selected for our final model.

We conducted a propensity score analysis as an additional approach to address the potential for differential sorting of patients into profit and not-for-profit agency care, and the large number of hypothesized confounders relative to our sample size. Propensity scores allow for a ‘quasi-randomized’ experiment to identify the effect of treatment by creating balance between exposure groups simultaneously on several measured confounders³⁸. The propensity score in this analysis is interpreted as the conditional probability of an individual receiving care from a for-profit agency given the individual’s set of observed characteristics³⁸.

We generated propensity scores using a multiple logistic regression model including confounders identified in the initial polytomous logistic regression model above, additional weak confounders, and variables associated with the outcome³⁹. Because the NHHCS sample design does impact estimates of the relationships among our variables of interest, with beta estimates changing markedly with and without weights, the propensity score model was developed using survey weights and design variables. Model discrimination, and the balance of specific confounders within strata defined by quintiles of the propensity score were evaluated graphically³⁸. Propensity scores, once generated, were used to control for confounding by inclusion as a covariate in a polytomous logistic regression model. Variables used to construct the propensity score appearing unbalanced within propensity score strata were evaluated for residual confounding by adding each variable to the propensity score adjusted model. None caused additional changes to the measure of the effect of profit orientation on hospitalization.

While there was overlap at the tails of the initial propensity score model distribution, we found the for-profit and not-for-profit groups were skewed in opposite directions, increasing the potential for concealed residual confounding in the tails of the distributions⁴⁰. We conducted an additional propensity score adjusted regression, restricting the analysis to only those individuals with a propensity score within ten percent of a comparison group member's propensity score. Each individual in the for-profit group was allowed only one match from the not-for-profit group. The set of variables used in the first propensity score model was used to create new propensity scores based on this restricted sample. Polytomous logistic regression estimates adjusting for the new propensity scores were conducted on the reduced sample using the new propensity score estimates and estimates of the effect of profit orientation on hospitalization calculated.

RESULTS

Sample

The average age of the sample was 72. Sixty-five percent were women (65.4%) and three quarters were white. Forty-four percent were currently unmarried, divorced or widowed (44.1%). The average length of service was about 50 days. Within 60 days, 131 (14.6%) were hospitalized, 37 (1.6%) died, 27 (1.4%) were admitted into a nursing home or other inpatient setting, and 1109 (82.3%) had a neutral or positive discharge, or remained in HHA care.

Bivariate Analyses

Bivariate analyses did not reveal strong differences among profit and not-for-profit HHA patients by demographic, clinical and caregiver characteristics. However, differences in potential confounders are noteworthy (Table 1): payer source (Medicare-not-Medicaid: 64.1% FP, 72.2% NFP), referral source (Hospital: 39.5% FP, 52.6% NFP). Patients of for-profit agencies had longer mean lengths of service (Days: 54.5 FP, 45.5 NFP).

Individuals in not-for-profits were less likely to have functional impairments (Needs assistance in any of six activities of daily living (ADLs): 49.3% FP, 39.8%NFP). However, not-for-profit patients had a higher burden of comorbid conditions (Charlson score of three or more: 8.3% FP, 16.5% NFP) (see Table 2).

Differences in the distribution of patients by characteristics of for-profit and not-for-profit agencies were notable (Table 3), with more individuals in for-profits receiving care from smaller organizations (Mean current patients: FP, 431, NFP, 709) and chain members (FP, 59.8%, NFP, 41.1%).

Multivariable Analyses

The crude estimate of the relation between profit orientation and hospitalization shows individuals receiving care from for-profit HHA to have lower odds of hospitalization within 60 days of HHA admission than not-for-profit patients (Odds Ratio (OR):0.51), while having twice the odds of dying within the same time period (OR: 2.62). After adjustment for comorbidity, agency chain membership, age and payment source (Table 4), the point estimate for hospitalization increased to .89, but with a wide confidence interval suggesting no difference between outcomes of patients receiving care from for-profit and not-for-profit HHA. The full model yielded an odds ratio of 1.12 for

hospitalization, but also could not be differentiated from an odds ratio of one, or no effect. Adjusting for individuals' propensity to be admitted into the care of a for-profit HHA resulted in similar estimates. Propensity score adjustment based on only those patients who matched on propensity score within 10% resulted in higher odds of hospitalization for for-profit HHA patients (OR: 1.31), and the odds ratio for death decreased to 1.31. These estimates were based on a sample size of 700, with outcomes distributed as follows: 67 hospitalizations, 17 deaths, 13 NH or other inpatient admissions, and 603 individuals in the referent category.

DISCUSSION

In this study we used the nationally representative National Home and Hospice Care Survey, including data on home health agency discharges for patients with all payer types, to assess the impact of HHA profit orientation on patient risk for hospitalization within 60 days of admission to agency care. This study fills a gap in the literature considering the impact of profit status on quality, and by considering hospitalization in the context of competing risks for other discharge outcomes. This study also provides an example of propensity score modeling applied to a health services research question. Propensity score modeling is a useful tool given the multitude of potential confounders in our study, and likely differential selection into for-profit and not-for-profit agency care given our hypothesis of profit status' influence on organizational behavior. Propensity score analysis allows simultaneous control for several measured potential confounders and should adjust for 'confounding by indication.' Although the most deconfounded point estimate from our analysis does show higher odds of hospitalization for for-profit

agency patients (OR: 1.31), the uncertainty in our estimate does not allow us to state that it supports our a priori hypothesis that patients receiving care from for-profit agencies would have higher hospitalization risk.

Whether the results of this study are due to similar quality care provision across profit status is not conclusive. However, theoretical and empirical supports do exist for the notion that for-profit and not-for-profit HHAs may behave similarly in the current home health sector. A recent analysis of length of service by patients cared for by for-profit and not-for-profit HHA before and after HHA PPS implementation suggests that there is no relationship between length of service and profit orientation¹⁴. According to institutional theory applied to health care organizations, under conditions of high environmental uncertainty where availability of resources such as patient referrals or reimbursement may be restricted, for-profit and not-for-profit organizations may behave more alike in a process of isomorphism^{8, 14, 16, 17, 41}. The history of the HHA sector has been marked by rapid changes and instability. Research cites early shifts in funding of not-for-profit agencies from charitable donations to dependency on state and federal funding, and growth of competition in the 1980s when restrictions on for-profit HHA Medicare participation were dropped, as potential factors influencing not-for-profits to become more similar to for-profits^{42, 43}. The 1983 implementation of hospital PPS also had a major effect on the HHA market, rapidly increasing demand for HHA services as hospitals discharged patients ‘quicker and sicker,’ while many hospitals entered the HHA market as they opened or acquired their own HHAs^{19, 41}. The implementation of the more explicitly structured system of HHA PPS may have also influenced for-profit and not-for-profit HHAs to behave more similarly¹⁴.

We interpret the current study findings with caution though, as several non-causal explanations related to sample size and potential confounders must be considered. The small sample size relative to the number of potential confounders makes it difficult to draw firm conclusions. Our analysis of referral sources suggests for-profit and not-for-profit agencies do care for different types of patients. Further, our bivariate comparisons of the distribution of patients among for-profits and not-for-profits did show distinct differences in agency characteristics, including marked regional variation, and much smaller patient counts for FP agencies, a finding consistent with prior analyses of the 1996 and 1998 waves of the NHHCS²⁴. Prior studies of the relation between profit status and agency processes suggest other organizational characteristics might modify the relationship between profit status and quality, with potential implications for home health care quality, but the current study sample was too small to evaluate these possible influences. Clarke and Estes found meaningful differences in organizational characteristics when looking at a subsample comprised of only generalist HHAs, defined as agencies providing the average number or more of different types of services¹⁹. The same study also found differences among non-chain for-profit and not-for-profit HHAs¹⁹. Schlesinger also notes the importance of context on the impact of profit orientation on organizational behavior⁸; however, the impact of regional variation in the distribution of HHA as observed in our study could not be pursued further. Also, a recent Canadian study showed that HHA contracting with for-profit service providers had worse performances on Home Care Quality Indicators⁷. An analysis of HHAs including market characteristics and conducted on a larger study sample allowing for control of more variables would be an addition to this field of research.

Ideally, hospitalizations that are indicators of poorer quality care should be those that are preventable. Prior studies looking at care provided in other settings such as nursing homes³ have used the strategy of restricting the study sample to only those individuals with diagnoses falling in a modified set of ambulatory care sensitive conditions⁴⁴, to potentially better isolate hospitalizations sensitive to health care delivery. This strategy was not used in the current study because the loss of sample size. Regardless, if adjustment for individual risk factors for hospitalization is sufficient, marginal differences in hospitalization rates should be indicative of agency care and relevant organizational processes, including clinical decision making and communication with staff and other medical care providers^{4, 45}.

While hospitalization may not be as sensitive to agency quality problems as other measures, prior studies provide evidence that quality home health care can impact hospitalization rates. The quasi-experimental design of two Outcome-Based Quality Improvement (OBQI) demonstration trials, which implemented a combination of data collection, outcome analysis and continuous quality improvement methods, lends strong support to this supposition⁴. HHA participating in OBQI over the 3 and 4 year trials had 25 and 27% reductions in risk-adjusted relative rates of hospitalization, respectively, in contrast to the less than 1% reduction found in the national comparison sample over the same period⁴. Prior research on individuals receiving post-acute home health care, compared to other post-acute care settings or no care, has found patients discharged to HHA care have reduced readmissions⁵.

Other limitations to the current study that should be mentioned are the potential for residual and unmeasured confounding. For patients admitted to agency care following a

hospital stay, transition quality, including communication between the hospital and agency, and appropriateness of discharge timing may have an important impact on hospitalization risk⁴⁶ which we could not evaluate here. Other social-psychological factors like stress, life satisfaction, compliance with therapy associated with hospitalization could also not be evaluated^{3, 46}. It is also possible that the caregiver variables in the NHHCS may not adequately characterize the ability of a patient's caregiver to support the patient in the community.

In conclusion, findings from the current analysis do not support our a priori hypothesis that patients of for-profit HHA are at higher risk for hospitalization. Evidence that for-profit and not-for-profit HHAs may provide care at similar levels of quality is also not conclusive. However, for-profit and not-for-profit HHA dependency on Federal reimbursement, high levels of competition, and the institution of a highly structured reimbursement system may have influenced for-profits and not-for-profits to behave very similarly with the result that agencies are providing a similar level of care. Further analysis, investigating whether similarities persist when looking at subsets of HHAs by agency characteristics, including chain, or generalist agencies, in addition to looking at environmental context such as regional competition, will be an important next step.

TABLES

Table 1.1: Patient Demographic Characteristics by HHA Profit Orientation

(% , unless otherwise noted)		For-Profit	Not-for-Profit
	n =	816	488
	weighted n =	1,063,585	1,132,930
Women		69.6	61.5
White ^a		73.2	77.0
Age (years):	<65	25.2	23.6
	65-74	21.1	21.8
	75-84	30.0	37.5
	85+	23.7	17.1
Married		44.0	44.3
Lives with:	Family	63.2	61.8
	Nonfamily	3.0	6.0
	Lives Alone	33.8	32.2
Has a caregiver		81.1	87.2
Primary & Secondary Payer:			
	Medicare not Medicaid	64.1	72.2
	Medicaid not Medicare	8.5	6.8
	Dual Eligible	7.5	4.6
	Private Insurance/Own Income	19.9	16.5
Referral Source ^b :	Hospital	39.5	52.6
	Physician	52.1	40.2
Length of Service mean days (SE)		54.5 (5.8)	45.5 (4.1)

^a Includes Hispanic^b Can have multiple referral sources

Table 1.2: Patient Clinical Characteristics by HHA Profit Orientation

(%, unless otherwise noted)	For-Profit	Not-for-Profit
ADL Dependencies:		
None	50.7	60.2
One Dependency	7.7	3.0
2 or More Dependencies	41.6	36.8
IADL Dependencies:		
None	64.3	69.8
One Dependency	22.5	19.8
2 or More Dependencies	13.2	10.4
Charlson Comorbidity Score:		
0	42.5	37.7
1	31.0	30.3
2	18.1	15.5
3+	8.3	16.5
Diagnostic or surgical procedure	31.6	37.8
Major Comorbidities ^a :		
Chronic Heart Failure	14.7	11.0
Cancer	8.6	14.6
COPD	14.4	9.5
Diabetes	19.5	25.7
Aids used upon HHA admission:		
IV equipment	3.9	1.8
Oxygen	7.1	10.3
Indwelling urinary catheter	5.1	5.6

^a Major comorbidities occurring in any of 6 listed HHA admission diagnoses

Table 1.3: Patient Distribution by HHA Characteristics, by HHA Profit**Orientation**

(% , unless otherwise noted)

Agency Characteristics	For-Profit	Not-for-Profit
Chain Member	59.8	41.1
Metropolitan Statistical Area	87.0	88.8
Census Region		
Northeast	21.2	56.0
South	45.3	24.6
West	16.6	10.1
Midwest	16.9	9.3
Number Current Patients (defined by quintiles of total)		
1-99	34.0	5.4
100-221	22.4	19.2
222-446	21.5	14.9
447-918	7.6	33.2
918 or more	14.5	27.3

Table 1.4: Adjusted Estimates for Association Between Profit Orientation and Hospitalization, Death or Other Inpatient Admission^a

		Adjusted	Propensity	Matched
		Logistic	Score	Propensity
	<u>Crude</u>	<u>Model^b</u>	<u>Adjusted^{b,c}</u>	<u>Adjusted^{b,c,d}</u>
Odds Ratio				
(95% Confidence	OR	OR	OR	OR
Interval)	(95%CI)	95%CI)	(95%CI)	(95%CI)
Hospitalized	0.51 (0.28-0.94)	0.89 (0.52-1.51)	0.97 (0.53-1.75)	1.31 (0.60-2.86)
Died	2.62 (0.61-11.23)	3.24 (0.71-14.79)	2.77 (0.64-12.05)	1.31 (0.25-6.86)
NH or Other	0.79 (0.22-2.83)	0.86 (0.25-2.99)	0.82 (0.27-2.50)	0.69 (0.16-3.07)
Inpatient Admission				

^a Censored/Neutral/Positive Discharge is referent outcome

^b Adjusted for: Charlson comorbidity score, chain membership, age (<65, 65-74, 75-84, 85+), and payment source.

^c Adjusted for: gender, region, race, adl, iadl dependencies, indwelling urinary catheter, use of oxygen or IV upon HHA admission, lives with family, non-family or alone, urbanicity, size of current patient population (quintiles), and hospital and/or physician referral.

^d Restricted to individuals with comparison group match with a propensity score within 0.1.

**CHAPTER 2: The Impact of Home Health Agency Profit Status on Risk for
Hospital Readmission Among Post-Acute Care Medicare Home Health
Beneficiaries**

ABSTRACT

Objectives: To quantify the impact of home health agency (HHA) profit orientation on Medicare post-acute care patients' risk for receiving poor quality care, measured as rehospitalization within 60 days of home health admission.

Research Design and Subjects: A retrospective cohort study of 520,319 non-institutionalized Medicare post-acute home health beneficiaries 65 years and older, admitted to 2,698 free-standing HHAs from October 2003 to September 2004.

Individual-level data were obtained from the Outcome Assessment Information Set for patients of HHAs identified as for-profit or non-for-profit in the Medicare Healthcare Cost Report Information System.

Results: Patients of for-profit agencies were rehospitalized within 60 days of HHA admission slightly more often than patients of not-for-profit HHAs (For-profit (FP): 16.7%, Not-for-profit (NFP): 15.8%). For-profit agencies cared for patients with higher disability scores (Score ≥ 7 - FP: 16.7%, NFP: 11.9), but patients were similar on most other clinical characteristics. Crude multi-level regression estimates show higher risk for patients of for-profit HHAs than those receiving care from not-for-profits (OR: 1.11, 95% CI: 1.07-1.15). However, after adjusting for measured hospitalization risk factors, we found no difference in 60-day rehospitalization risk (Odds Ratio (OR): 1.00, 95% Confidence Interval (CI): 0.97-1.03). This finding persisted after considering whether HHAs were located in rural or urban areas.

Conclusions: Our findings suggest there is no difference in the quality of care provided to post-acute care patients by free-standing for-profit and not-for-profit HHAs. Increased

competition, reimbursement policy changes, and public reporting may influence agencies to behave similarly, resulting in similar levels of quality.

Key Words: Home health care agencies, post-acute care, ownership, rehospitalization, quality

INTRODUCTION

Home Health and Post-Acute Care

Home health agencies (HHAs) are increasingly important providers of post-acute and other skilled care in the United States. Medicare home health spending rose an average of 7.5% per year from 2000 and 2007, or from 8.5 to 14.1 billion, while Medicare spending for post-acute care (PAC) rose an average of 9% per year, from 24.7 to 45.1 billion for the same period⁴⁷. HHAs provide care for the largest segment of Medicare post-acute care patients (16%) after skilled nursing facilities (17%)⁴⁷.

Rehospitalization

Concern about the rate and associated cost of rehospitalization among Medicare funded home health patients has grown^{6, 48}. The Office of the Inspector General reports that, from 2000 to 2004, 47% of Medicare home health beneficiaries starting a home health episode within 30 days of a hospital discharge are rehospitalized⁴⁹. Risk-adjusted agency-level rates of rehospitalization publicly reported by the Centers for Medicare and Medicaid Services (CMS) as a measure of HHA quality vary widely⁵⁰, suggesting that organizational-level differences may affect the quality of care provided. The current retrospective cohort study quantifies the impact of HHA organizational characteristics, particularly agency profit orientation, on patients' risk for receiving poor quality PAC. We use risk for rehospitalization within 60 days of home health admission as a global quality measure.

Profit Orientation and Quality

In this study we were interested in quantifying the impact of organizational goals, as represented by agency profit orientation, on quality. Resource dependency theory

explains organizational behavior as a response to the environment where organizations continually position themselves to acquire and maintain supplies of resources^{15, 16}. Priorities of key resource suppliers therefore drive organizational mission¹⁷. Thus, whereas for-profits have pressures to return profits to share-holders and owners¹⁸, not-for-profits must conform to community and government imposed mandates, including provision of unprofitable services and charity care, in exchange for tax-exempt status¹⁹. As a consequence, for-profit agencies may be more likely to make choices to increase revenue and reduce costs than not-for-profits, which, in a fixed system of reimbursement like the Medicare home health prospective payment system (PPS), may create incentives to reduce services, putting patients at risk. This may be reflected in incentive for for-profits to discharge costly patients to inpatient settings. We hypothesized that post-acute patients of free-standing for-profit HHAs are at higher risk for rehospitalization within 60 days of HHA admission than non-profit patients.

In 2002, 49% of all Medicare certified agencies (freestanding and facility-based) were proprietary¹. While the association between profit status and quality has been extensively reviewed in other health care sectors⁸, there is limited literature looking at this relationship among HHAs^{11, 12, 14}. In general, studies of nursing home, hospital and kidney dialysis centers report that for-profits fare more poorly on measures of quality⁸.

Research comparing for-profit and not-for-profit HHAs has focused on differences in process measures, costs, and changes in agency behavior in response to policy changes, including provisions of the Balance Budget Act, which instituted home health PPS under Medicare. While studies of the period prior to full home health PPS implementation show for profit HHAs provided more visits per case, had higher costs and

revenues and used more contract and part-time staff than not-for-profits^{13, 16, 23}. By contrast, studies of the period after PPS implementation have yielded mixed results. Reports have found for-profits had larger reductions in median length of service^{24, 25} and visits per patient²⁵ than not-for-profits post-PPS. Recent analyses, however, suggest that there is no relationship between length of service and profit orientation following implementation¹⁴.

The present study adds to the literature by addressing the gap in recent research on the impact of profit orientation on the quality of care provided by HHAs¹¹⁻¹³. We used data from a longitudinal census of patients receiving Medicare or Medicaid funded home health care from Medicare certified HHAs, linked with publicly available agency-level data. This allowed us to control for confounding at both the individual- and agency-level in addition to correlation due to clustering of individuals within HHAs.

METHODS

Data Sources

We obtained individual-level data from the Outcome and Assessment Information Set (OASIS), submitted by agencies, as a condition of HHA participation in Medicare, to CMS on all HHA patients receiving Medicare or Medicaid funded home health care. Data are collected via assessments completed by a registered nurse, physical therapist, speech language pathologist or occupational therapist. They include patient demographics, history, functional, behavioral and clinical status, living arrangements, informal assistance, and care needs. Assessments are completed at start of care, resumption of home health care after an inpatient transfer lasting less than 24 hours, follow-up at 60

days or for changes in health status, in addition to discharge, transfer, or death. Data are used to adjust Medicare payments to account for differences in costs due to patients' severity, functional status and service needs⁵¹, and for public reporting and other outcome-based quality improvement efforts. We obtained agency profit orientation from the Medicare Healthcare Cost Reports Information System (HCRIS). Data submitted by agencies to Fiscal Intermediaries as a condition of Medicare participation, are used for audits and to set prospective payment rates for subsequent periods⁵². These data have been used extensively to characterize health care providers^{53, 54}.

Sample

The sample included all non-institutionalized Medicare post-acute home health beneficiaries 65 years and older admitted to a non-facility-owned HHA in the United States from October 2003 to September 2004. We identified post-acute patients as having had an acute care hospitalization within the 14 days prior to the HHA start of care assessment (39% of all start of care assessments). If an individual had more than one start of care assessment within the study period we selected one assessment at random for inclusion (approximately 2% of all individuals prior to applying agency-level restrictions). We excluded 200 agencies (serving 3% of post-acute patients) missing profit information in the HCRIS and 330 agencies with a change in profit status reported between October 2000 and October 2005 (serving 3.2% of post-acute patients). Change in ownership may be a sign an agency is having financial problems, which may impact agency care quality⁸. Strong linkages, like ownership, between agencies and inpatient facilities likely alter risk for rehospitalization by affecting incentives and quality of communication⁵⁵. We therefore excluded hospital-, and nursing home-owned HHAs from

our analysis (1803 agencies serving 26.8% of post-acute patients). We excluded the small group of patients receiving care from government-owned agencies hypothesizing that these agencies would behave differently than for-profits and not-for-profits, and largely serve different kinds of patients (298 agencies serving 1.5% of post-acute patients). We also excluded individuals for whom we could not match a start of care assessment to a subsequent assessment to identify an outcome (n=54,013, 3.9% of post-acute patients, evenly distributed across HHA profit status). We restricted the sample further to exclude HHAs with fewer than 20 individuals (36.9% of HHAs serving 1% of post-acute patients) to improve our ability to implement our modeling approach without convergence problems. Due to the small proportion (1.4%) of individuals with outcomes of death or transfer to a nursing home, rehabilitation, or skilled-nursing facility in our final sample we excluded individuals with these outcomes, resulting in a final sample of 2,698 agencies and 520,319 individuals.

Outcome Measure

Conceptually, we sought to quantify occurrences of poor quality care by HHAs, measured here as any transfer to an acute care hospital from HHA care within 60 days of admission to the HHA, except for transfers for planned surgery or chemotherapy⁵⁶. The majority (over 80%) of home health care discharges occur within 60 days of HHA admission²⁷, the length of a Medicare home health reimbursement episode. We used a dichotomous outcome comparing acute care hospitalization to a referent outcome including positive (to the community, admitted to hospice⁵⁷), or neutral discharge (e.g. moved, hospitalization for planned surgery or chemotherapy, etc.), or still receiving HHA services. To obtain length of service and outcomes, we matched Start of Care to Transfer

or Discharge assessments using individual and agency unique identifiers and start of care dates, which are listed on all assessments. We then identified individuals' first discharge or transfer, or date of death. For patients admitted to an inpatient facility within 60 days, we identified type of facility from the Transfer assessment.

Exposure

We determined HHA profit orientation by matching the HCRIS file to OASIS using Medicare provider numbers. We combined levels to generate the exposure variable as follows: non-profit (including: voluntary church, voluntary other private); and for-profit (including: sole proprietor, partnership, corporation).

Potential Confounders

We reviewed the literature to identify independent risk factors for hospitalization of home health patients and potential confounders of the exposure-outcome relationship in our sample, particularly focusing on acute care hospitalization risk adjustment models using OASIS^{33, 58, 59}. We included age^{29, 59}, and gender^{28, 29}. Since patients with other non-agency supports have lower risk for rehospitalization⁶⁰, we also control for living arrangements (lives with spouse, with others, both spouse and others, lives alone) and whether the patient resides with a non-agency, unpaid assisting person at home⁶¹. We controlled for managed care versus fee-for-service coverage⁵⁹, since studies suggest that patients with HMO coverage have fewer preventable hospitalizations⁶², however it is not possible to differentiate patients with HMO coverage from other type of managed care in our data.

Clinical characteristics we evaluated include bowel or urinary incontinence, presence of a urinary catheter, intractable pain, and dyspnea^{33, 59}. Presence of lesions

and ulcers at admission may indicate a very ill or functionally impaired patient, but also poor hospital care prior to HHA admission, therefore we considered integumentary status³³ (no lesion or wound, lesion other than pressure or stasis ulcer or surgical wound, surgical wound only, pressure or stasis ulcer with no surgical wound, pressure or stasis ulcer with surgical wound). We also included acute and home health diagnoses grouped into categories used for home health case-mix and risk adjustment measures by CMS⁶³. We based acute care diagnosis groups on hospital discharge diagnoses listed for the hospitalization preceding HHA admission and the home health admission diagnosis groups on diagnoses listed as the primary reason for receiving home health care⁶³. We included severity of an individual's most problematic HHA admitting diagnosis (asymptomatic or well controlled, controlled with difficulty, poorly controlled, history of rehospitalization)³³ and a count of diagnoses controlled with difficulty or described as higher severity⁵⁹. We also considered the receipt of any injection medications as another measure of severity. Ventilator use⁵⁹ was very small (0.05%) so we created a combined indicator with oxygen therapy³³. We also included indicators for presence of enteral or parenteral nutrition therapy³³, intravenous therapy at admission^{33, 59}, and good overall and rehabilitation prognoses^{33, 59}.

For cognitive and emotional status we included confusion (never, in new or complex situations only, on awakening, during day and night, constantly), anxiety (none, less than daily, daily, constantly), depression or any associated symptoms, and behavioral problems⁵⁹. For functional status, we calculated a scaled composite disability score (with a range of 0 to 13) summarizing need for assistance in eight activities of daily living (ADLs) and five instrumental activities of daily living (IADLs), excluding telephone use

because of missing values. We assigned individuals a scaled score out of 1 for each ADL or IADL item based on its reported value (which ranged from 0-2 to 0-5), with the total score equal to the sum of all scaled items. For ease of interpretability and to avoid imposing a linear relationship readmission risk, we categorized the variable to whole number values that approximate quartiles of the distribution, with additional categories subdividing the upper end of the disability scale where we anticipated the largest effect. We also included an indicator of any need for medication administration assistance³³.

Larger agencies may have more resources for staff hiring, or development of specialized or comprehensive services^{64, 65}. Alternatively, larger size might result in reduced administrative control and oversight or poor coordination of care{{; 1004 Zinn,J.S. 1998; }}. We determined agency size by generating an unduplicated count of all clients⁶⁵, regardless of referral source, with a start of care assessment during the study period. We also used these counts to calculate the percentage of all agency patients receiving post-acute care. Agencies with higher percent post-acute care may specialize in caring for hospital referrals, or have an unmeasured relationship with the referring hospital. We also considered whether HHAs were urban or rural, positing that proportionately more for-profit HHAs would be located in urban areas. This is an important consideration because urban HHAs may have financial resources otherwise unavailable to rural HHAs⁸, not to mention better supplies of educated staff. We did not consider chain status, because 99% of the free-standing for-profit agencies in our sample were members of a corporation or partnership.

Analytic Approach

We conducted bivariate comparisons to assess potential confounding by the above individual, agency and geographic characteristics. We then conducted two-level multilevel regression analyses, accounting for the clustering of individuals within agencies. Individuals within an agency are likely to have similar clinical and demographic characteristics and be exposed to similar agency organizational policies and care practices. This analysis is best explained using three separate models, one for each level. The patient-level model is:

$$(i) \text{ Log} \left(\frac{P_{rehospitalization}}{1 - P_{rehospitalization}} \right) = b_{0ij} + \mathbf{b}_{ij} \mathbf{IndividualLevelConfounders}$$

where i =patient and j =HHA and $\mathbf{b}_{ij}$ is the matrix of regression coefficients for a matrix of individual-level confounders. The agency-level model is:

(ii)

$$b_l = g_{l0} + g_{l1} \text{profitorientation} + g_{l2} \text{size} + \dots + g_{ln} \text{AgencyLevelVariables} + E_{lj}$$

Where b_{ljk} is the l 'th regression coefficient for agency j within market k from the first level model and E_{ljk} is an agency-level error term. This model assumes that individual-level variation in risk for rehospitalization has a systematic component attributable to characteristics of the HHA. These models can be combined:

$$(iii) \text{ Log} \left(\frac{P_{readmission}}{1 - P_{readmission}} \right) = R_{ij} + A_j + E_j$$

Where R_{ij} is the linear predictor of patient effects, A_j is the linear predictor of agency effects, and E_{0j} accounts for random variation at the agency level. This is a random intercept value which assumes facility variability. The measure of effect estimated is an odds ratio, calculated by taking $e^{g_{profitorientation}}$, and interpreted as follows: *The odds of rehospitalization for individuals cared for by a for-profit HHA are N times the odds for individuals cared for by not-for-profit HHA.* Bivariate analyses were conducted using SAS (SAS Institute, Cary, NC) and regression analyses using the GLLAMM procedure in STATA (Version 10.0, StataCorp, College Station, TX).

We first ran a crude analysis of the impact of profit orientation on rehospitalization, and then evaluated potential confounders in an iterative process. If a variable, when entered individually into the model, changed the profit orientation estimate by more than five percent we considered it a confounder and retained it in the model⁶⁶. We also ran a full model including all potential confounders to evaluate residual weak confounding by variables not selected for our parsimonious model. Speculating that the effect of profit orientation might be different for rural and urban agencies, we evaluated whether urban or rural location modifies the effect of HHA profit status on patient rehospitalization risk by running a full model with dummy variables that allowed us to obtain the risk for hospitalization for patients of for-profit, rural HHAs, for-profit urban HHAs and not-for-profit rural HHAs relative to not-for-profit urban HHAs.

RESULTS

Table 1 shows for-profit agencies tended to be in metropolitan areas (FP: 79.8%, NFP: 63.6%), smaller than not-for-profits (median count of patients served – FP: 207,

NFP: 454), and cared for proportionately fewer post-acute patients (median – FP: 52.0%, NFP: 63.6%). The median agency-level rate of rehospitalization during the study period was 17.0%, with a range from 0 to 50%. Patients of for-profit agencies were rehospitalized within 60 days of HHA admission at a rate of 16.7%, while 15.8% of patients of not-for-profit HHAs were rehospitalized. Proportionately more for-profit agency patients (9.0%) were still receiving agency care at 60 days from HHA admission compared to not-for-profit agency patients (5.2%).

The patient loads of not-for-profit agencies were more likely to be covered by managed care (FP: 10.0%, NFP: 13.9%). Patients of for-profit and not-for-profit agencies were similar on living arrangements and characteristics of non-agency persons providing assistance (Table 2). For-profit agencies cared for patients with higher disability scores (Score ≥ 7 – FP: 16.7%, NFP: 11.9%), but these patients needed medication assistance at similar rates to patients of not-for-profits (FP: 51.8, NFP: 49.7%). For-profit and not-for-profit agency patient populations were similar on most clinical characteristics, including acute care diagnoses, integumentary status, severity of home health admitting diagnosis, and rehabilitation and overall prognoses (Table 3). They also had similar rates of intractable pain, bowel incontinence, use of enteral or parenteral nutrition, and respiratory therapies. However, patients receiving care from for-profit agencies had more severe dyspnea (with minimal exertion or at rest – FP: 16.8%, NFP: 12.3%), speech impairments (any – FP: 25.1%, NFP: 21.3%), and musculoskeletal home health admission diagnoses (FP: 33.2%, NFP: 26.7%). While patients of not-for-profits were more likely to have cardiac acute care diagnoses (FP: 28.9%, NFP: 32.8%), for profits patients had slightly

more depression (FP:17.6%, NFP: 14.9%) and behavioral problems (FP:16.0%, NFP: 13.3%), but similar levels of cognitive impairment, anxiety and confusion.

Table 4 presents the results of our crude and fully-adjusted multilevel regression analyses. Crude estimates show patients of free-standing for-profit HHA had a higher risk of rehospitalization within 60 days of HHA admission than those receiving care from not-for-profits (OR: 1.11, 95% CI: 1.07-1.15). The fully adjusted model, however, shows no difference after adjusting for all measured hospitalization risk factors (OR: 1.00, 95% CI: 0.97-1.03). Our partially adjusted model includes only variables identified as confounders: disability, dyspnea and cancer, circulatory, endocrine, respiratory and musculoskeletal home health admission diagnosis groups, and percent of HHA patients that are post-acute. This model did show a slightly lower risk for rehospitalization among patients of for-profit HHAs (OR: 0.96, 95% CI: 0.92-0.99). The impact of agency profit status was similar by rural or urban location.

DISCUSSION

Our findings do not support the hypothesis that post-acute Medicare home health beneficiaries receiving care from free-standing for-profit HHAs are at increased risk for rehospitalization compared to patients of free-standing not-for-profit HHAs. Our fully adjusted model suggests that there is no difference in risk for rehospitalization by agency profit orientation. We also found that there was no differential effect of profit status by urban and rural location.

Post-acute patients of free-standing for- and not-for-profit HHAs were very similar on the majority of risk factors for hospitalization considered. It is therefore not

surprising that we found few strong confounders of the relationship between profit orientation and rehospitalization, even when the risk factors themselves had a strong influence on rehospitalization. However, bivariate results do suggest patients of for-profit agencies were likely receiving care for more chronic conditions as they had more severe dyspnea, functional dependencies, depression and behavioral problems. These findings are consistent with a prior study comparing for-profit and not-for-profit HHAs using the National Home and Hospice Care Survey⁶⁷.

Institutional theory applied to health care organizations provides an alternative explanation more in line with our study's results. When health care organizations are exposed to uncertain conditions and restricted resources, such as patient referrals and reimbursement, they may respond similarly, mimicking actions of other health care organizations, in an attempt to survive in a process of isomorphism^{8, 14, 16, 17, 41}. The HHA sector has indeed been marked by rapid changes and instability including multiple revisions to restrictions on agency participation^{19, 42} and individual Medicare home health benefit eligibility rules⁶⁸. Changes in Medicare reimbursement policy, including hospital PPS implementation in 1983, which increased demand for post-acute care services, as hospitals discharged patients "quicker and sicker", and also increased hospital diversification into the HHA market^{19, 41}, have impacted HHAs as well. Later implementation of home health PPS with the Balanced Budget Act of 1997¹⁴ further imposed restrictions on HHAs' resources and practices by placing stricter controls on reimbursement and requiring detailed reporting by agencies. Our findings, therefore, are not inconsistent with resource dependency theory, which grounded our initial hypothesis that rehospitalization rates would be higher among for-profits. An alternate application of

this theory is that increased post-acute care competition, HHA dependence on Federal reimbursement, and full implementation of public reporting in Oct 2003, designed to encourage competition on quality through CMS's online database Home Health Compare, may present much stronger influences on agency behavior as they position themselves to acquire resources, than those represented by tax status. Many have commented on the increasingly fuzzy distinction between for-profit and not-for-profit health care organizations, resulting in part from widespread consolidation and corporate restructuring trends in the healthcare market, which have refocused management culture, regardless of profit status, to emphasize competition and strategy⁶⁹. Where little regulation of not-for-profits' compliance with the non-distribution constraint and a poorly informed set of consumers who tend to use not-for-profit status as a signifier of quality, exist, organizations may survive as 'not-for-profits' only in name⁷⁰ with little risk of consequences.

While we did not find an effect for our sample, we should note the possibility that HHA profit status may be more relevant to other HHA quality measures, such as patient satisfaction or improvement in clinical and functional measures, or more pertinent to care being provided to patients with more chronic needs. The post-acute needs of the patients in our analytic sample may be specific⁷¹ enough that the possibility of agency-level variation in care practices was reduced; for example, post-acute home health beneficiaries have diagnoses dominated by major joint or lower extremity procedures and replacements⁷². Additionally, other organizational characteristics, relationships or market factors may have more influence on agency-level rehospitalization rates. However, while we found that free-standing for-profit agencies are much smaller than not-for-profits, size

did not have an impact on rehospitalization risk in our sample, consistent with earlier studies suggesting that economies of scale do not apply to HHAs⁷³. Prior research has shown differences in organizational behavior among non-chain for-profit and not-for-profit HHAs¹⁹; however, we could not evaluate the impact of chains because the overwhelming majority of for-profits in our sample are chain members. This is the likely explanation for the difference in agency size across profit orientation, though we were not able to group HHAs into their member chains.

Other relevant agency characteristics not accounted for in the present study may be specialization in types of services provided¹⁹ or patients cared for. We did find a slight effect of the percentage of agency patients receiving post-acute care on rehospitalization risk, with higher risks for rehospitalization among patients of HHAs serving lower percentages of post-acute patients even in our fully adjusted model, accounting for several patient-level risk factors. In the current study, we did not control for agency characteristics indicative of organizational strategy, such as breadth of services available, use of contract workers, or proportion of services provided by lower skilled workers because these have been correlated with profit status in prior research^{13, 16, 23} and, we initially hypothesized these strategies might be the way differences in organizational behavior by for-profits and not-for-profits could result in differential rehospitalization risk by profit status.

We should also consider non-causal explanations for our findings. The variable used to select post-acute care patients, hospitalization in the 14 days prior to assessment for start of care, is included in the Home Health Resource Group (HHRG) calculations used to determine Medicare reimbursement. A differential tendency by profit status to

code patients as having a prior hospitalization when they did not would result in healthier patients in our sample of for-profit HHAs. Even if for-profits did not tend to code a prior hospitalization, a related concern that could explain our findings is that for-profits might avoid admitting high need patients in the first place, resulting in a healthier patient population than is found in not-for-profits. However, our data show sicker patients in for-profits, which is not consistent with either of these explanations. We should note that for-profit agencies might systematically up-code variables, such as dyspnea and selected ADL items as well, as they are also used in HHRG calculations. This hypothetical differential “up-coding” of patients in for-profit agencies could explain our results. Recent support for a general tendency of for-profit HHAs to ‘profit-maximize’ is suggested by a prior study that found, after adjusting for case-mix, that for-profit HHAs had a greater increase than not-for-profits in the proportion of home health episodes with 10 or more physical therapy visits, following changes to Medicare payments increasing reimbursement for episodes meeting this threshold ⁷⁴.

Another non-causal explanation for our findings might be that we did not specifically look at preventable rehospitalizations as our indicator of poor quality care³. A meta-analysis investigating the impact of hospital inpatient care processes on rehospitalization observed more inconclusive findings among studies that did not differentiate between planned and unplanned readmission, while those identifying unplanned readmissions consistently showed associations⁷⁵. However, if adjustment for individual risk factors is sufficient, marginal differences in hospitalization rates should be indicative of organizational quality. That we considered an extensive list of risk factors for hospitalization in our model building and also differentiated those rehospitalizations

that were clearly planned (for chemotherapy and planned surgery), suggests that our findings are truly negative rather than merely inconclusive.

Other limitations to consider include the possibility of unmeasured individual characteristics impacting risk for rehospitalization related to profit orientation of agency. These might include stress, life satisfaction, and therapy compliance⁴⁶ and unmeasured caregiver attributes related to the ability to support the patient in the community²⁸. Lack of strong confounding by measured patient and caregiver characteristics in our analysis minimize these concerns. Another possibility is that unmeasured differences in physician and hospital characteristics may influence variation in patient outcomes across for- and not-for-profit agencies. For example, poor communication of care plans and patient information between hospitals and HHAs during transition could result in higher patient risks.

Prior research also indicates that context has an important influence on the impact of profit orientation on organizational behavior⁸. Perhaps the most salient aspects of the HHA context not explicitly controlled for in the present study were market-level factors like variation in regional hospitalization rates, post-acute care utilization⁷², competition⁶⁵ and concentration of for-profit, or not-for-profit HHAs in the market. However, our analysis of HHA profit status by urban and rural location shows no difference in the impact of profit status on rehospitalization, regardless of whether the agency is in a rural or urban area.

In conclusion, findings from the current analysis suggest that there is no difference in quality of care provided to post-acute care patients by free-standing for-profit and not-for-profit HHAs, regardless of whether agencies are located in rural or

urban areas. Our study addresses a gap in the literature linking HHA organizational characteristics and quality. We also used a rich data set, which is not yet widely used in health services research, that allowed us to control for many individual- and agency-level characteristics, in addition to accounting for clustering of patients within agencies. Our findings suggest that profit-status may not be relevant to quality among free-standing HHA, at least when considering a more extreme measure of patient deterioration. Recent increases in post-acute care competition, and changes to Federal policy including instituting a highly structured reimbursement system, in addition to public reporting may have influenced agencies to behave similarly, resulting in similar levels of quality by for-profit and not-for-profit agencies.

TABLES

Table 2.1: Agency Characteristics by Profit Orientation

Agency Characteristic (%, unless noted)	For profit n=2123	Not-for-profit n=575
Size - median (std dev)	207 (1550)	454 (378)
<100	19.1	8.5
100-199	29.8	18.1
200-499	32.7	27.0
500+	18.4	46.4
Percent post-acute care - median percent (std dev)	52.0 (14.5)	63.6 (11.8)
<=43.6%	29.8	7.5
>43.6% to 55.1%	28.2	12.9
>55.1% to 64.5%	22.6	33.9
>64.5% to 72.5%	11.7	27.7
>72.5%	7.8	18.1
Urban	79.8	70.3

Table 2.2: Length of Service, Living Arrangements, Non-agency Assistance Available, and Functional Status by HHA Profit Orientation

Individual-level Characteristics (%, unless noted)	For-Profit	Not-for-Profit
	n=276,621	n= 243,698
Readmissions	16.7	15.8
Length of service – median days (std dev)	25.0 (18.5)	22.0 (16.8)
14 days or less	27.9	30.5
15-30 days	33.1	37.4
31-60 days	30.0	26.8
60 days or more	9.0	5.2
Managed care payer*	10.0	13.9
Living arrangements^		
lives with spouse	43.9	43.0
lives with others (family, friends, neighbors, paid)	26.9	24.7
lives with both spouse and others	4.2	4.4
lives alone	25.1	27.9
Has no one primary caregiver^	15.7	16.4
Non-agency assisting person characteristics		
comes in from outside home (unpaid)	29.8	31.6
resides in home (unpaid)	65.6	64.9
paid help	2.3	1.5
none of the above	2.3	2.0
Has no one primary caregiver	15.7	16.4

Individual-level Characteristics	For-Profit	Not-for-Profit
Disability, Scaled Score – median (std dev)	5.2 (2.1)	4.7 (2.0)
<3	15.8	19.8
3 to <4	14.2	17.3
4 to <5	16.8	18.1
5 to <6	19.7	18.6
6 to <7	16.8	14.4
7 to <9	13.0	9.6
9+	3.7	2.3
Medication assistance needed	51.8	49.7

* Referent is fee-for-service.

^ Missing values: no one caregiver – 521, non-agency assisting person characteristics – 335

Patients were similar on age (sample mean: 77.8%) and gender (59.2% female).

Table 2.3: Clinical Characteristics, by HHA Profit Orientation

Clinical Characteristics (% , unless noted)	For profit	Not-for-profit
Dyspnea		
never	33.4	38.1
walking more than 20 feet	24.4	29.1
upon moderate exertion	25.3	20.4
upon minimal exertion	13.5	9.9
at rest	3.3	2.4
Acute Care diagnosis group		
orthopedic	31.6	28.1
cardiac	28.9	32.8
pulmonary	15.9	16.5
HHA Admission diagnosis group		
cancer	10.1	12.8
circulatory	53.8	55.1
endocrine	25.3	24.7
musculoskeletal	33.2	26.7
respiratory	17.7	18.6
Highest severity HHA admission diagnosis		
asymptomatic or well controlled	1.7	1.7
controlled with difficulty	59.7	63.1
poorly controlled	32.8	30.8
history of rehospitalization	5.8	4.6
Integumentary status		
no lesion or wound	33.8	30.6

Clinical Characteristics (% , unless noted)	For profit	Not-for-profit
lesion –no pressure or stasis ulcer or surgical wound	16.4	18.6
surgical wound (observable only)	44.8	46.3
pressure ulcer or stasis ulcer (no surgical wound)	3.0	2.8
surgical wound plus pressure ulcer or stasis ulcer	2.0	1.8
Intractable pain	12.0	13.3
Bowel incontinence frequency or ostomy		
rarely or never	90.5	91.9
less than once per week	1.9	1.9
1-3 times per week	2.8	1.9
four or more times per week	3.0	2.2
ostomy	1.8	2.1
Urinary incontinence frequency, or urinary catheter		
never	71.4	74.5
timed voiding defers	5.2	6.0
at night only	2.0	1.3
during the day and night	17.4	14.1
catheterized	4.0	4.1
Depression and associated symptoms	17.6	14.9
Behavioral problems, any	16.0	13.3
Confusion^		
never	65.5	67.2
in new or complex situations only	26.3	25.9
on awakening or at night only	1.4	0.9
during the day and evening	5.7	4.8
constantly	1.3	1.1

Clinical Characteristics (% , unless noted)	For profit	Not-for-profit
Anxiety^		
none of the time	64.3	64.5
less often than daily	21.4	20.5
daily, but not constantly	13.1	13.8
constantly	1.2	1.2
Speech		
no impairment	74.9	78.7
minimal to moderate difficulty	23.2	19.9
severe to total impairment	1.9	1.4
Enteral or parenteral nutrition therapy	1.6	1.3
Receiving injection medications	14.7	13.3
Oxygen or ventilator use	12.7	11.5
Overall prognosis good	94.3	93.6
Rehabilitation prognosis good^	85.2	83.6

^ Missing values: confusion – 615, anxiety – 1559, overall prognosis – 6286, rehabilitation prognosis - 6572

Acute care diagnosis groups also considered, showing no difference across profit status: diabetes (5.0%), gastrointestinal (10.2%), neurologic (7.4%), psychiatric (1.4%), pulmonary (16.2%), other (15.7%).

HHA admission diagnosis groups also considered, also with no difference: contagious (2.1%), blood disease (6.5%), psychiatric (5.5%), nervous system (6.0%), digestive (9.9%), genitourinary (9.2), skin (5.5%), congenital (0.6%), fracture (5.2%), intracranial (0.3%), other injury (4.5%), iatrogenic (2.9%).

Patients were similar by count of HHA admission diagnosis groups controlled with difficulty or worse severity (49.7% with 4 or more), urinary catheterization (4.0%) and urinary incontinence frequency (15.9% occurring during both day and night), and receipt of IV therapy (2.2%)

Table 2.4: Crude and Adjusted Estimates of Association Between HHA Profit Orientation and Rehospitalization

	Crude OR		Adjusted OR*	
		(95% CI)		(95% CI)
For-profit	1.11	(1.07-1.15)	1.00	(0.97-1.03)
Not-for-profit	Ref		Ref	
Dyspnea				
never	Ref		Ref	
walking more than 20 ft	1.39	(1.36-1.42)	1.20	(1.17-1.23)
upon moderate exertion	1.94	(1.90-1.98)	1.36	(1.33-1.39)
upon minimal exertion	2.80	(2.73-2.87)	1.59	(1.54-1.63)
at rest	3.88	(3.73-4.03)	1.82	(1.74-1.90)
Disability, Scaled Score				
<3	Ref		Ref	
3 to <4	1.13	(1.10-1.16)	1.16	(1.13-1.20)
4 to <5	1.24	(1.20-1.27)	1.30	(1.26-1.33)
5 to <6	1.37	(1.33-1.40)	1.42	(1.38-1.46)
6 to <7	1.78	(1.73-1.82)	1.68	(1.63-1.74)
7 to <9	2.69	(2.61-2.76)	2.10	(2.04-2.18)
9+	4.37	(4.19-4.54)	2.58	(2.45-2.72)
HHA Admission diagnosis group				
cancer	1.76	(1.72-1.79)	1.54	(1.51-1.58)
circulatory	1.37	(1.35-1.39)	1.04	(1.02-1.07)
endocrine	1.34	(1.32-1.36)	1.14	(1.12-1.16)
musculoskeletal	0.74	(0.73-0.75)	1.00	(0.98-1.02)
respiratory	1.52	(1.49-1.54)	1.02	(0.99-1.04)

	Crude OR		Adjusted OR*	
		(95% CI)		(95% CI)
Percent post-acute care				
<=43.6%	1.11	(1.06-1.16)	1.05	(1.01-1.10)
>43.6% to 55.1%	1.08	(1.03-1.12)	1.05	(1.01-1.09)
>55.1% to 64.5%	Ref		Ref	
>64.5% to 72.5%	0.93	(0.89-0.96)	0.97	(0.93-1.00)
>72.5%	0.98	(0.95-1.02)	1.00	(0.96-1.04)
Urban location	0.87	(0.84-0.90)	0.94	(0.91-0.97)
Size (categorical)				
small (<100)	1.14	(1.08-1.21)	0.99	(0.94-1.01)
medium (100-199)	1.09	(1.05-1.14)	0.99	(0.95-1.03)
large (199-499)	Ref		Ref	
very large (500+)	0.95	(0.92-0.99)	1.02	(0.99-1.06)
Managed care payer	0.83	(0.81-0.86)	0.85	(0.82-0.87)
Integumentary status				
no lesion or wound	Ref		Ref	
lesion present no pressure or stasis ulcer or				
surgical wound	1.11	(1.09-1.14)	1.04	(1.02-1.07)
surgical wound (observable only)	0.60	(0.59-0.62)	0.76	(0.74-0.77)
pressure ulcer or stasis ulcer (no surgical wound)	1.92	(1.85-1.99)	1.33	(1.28-1.38)
surgical wound plus pressure ulcer or stasis ulcer	1.46	(1.39-1.53)	1.26	(1.20-1.33)
Highest severity HHA admission diagnosis				
asymptomatic or well controlled	Ref		Ref	
controlled with difficulty	1.42	(1.32-1.52)	1.18	(1.10-1.27)
poorly controlled	1.95	(1.81-2.09)	1.31	(1.21-1.40)
history of rehospitalization	2.66	(2.46-2.87)	1.39	(1.29-1.51)

	Crude OR		Adjusted OR*	
		(95% CI)		(95% CI)
Bowel incontinence frequency or ostomy				
rarely or never		Ref		Ref
less than once per week	1.56	(1.49-1.64)	1.06	(1.01-1.12)
1-3 times per week	1.95	(1.87-2.03)	1.12	(1.07-1.18)
four or more times per week	2.56	(2.46-2.65)	1.30	(1.24-1.36)
ostomy	1.48	(1.41-1.55)	1.38	(1.31-1.46)
Cardiac acute care diagnosis group	1.40	(1.38-1.42)	1.25	(1.22-1.28)
Orthopedic acute care diagnosis group	0.40	(0.40-0.41)	0.61	(0.60-0.63)
Enteral or parenteral nutrition therapy	2.55	(2.42-2.67)	1.49	(1.41-1.57)
Rehabilitation prognosis good	0.41	(0.41-0.42)	0.73	(0.71-0.74)
Medication assistance needed	1.99	(1.96-2.02)	1.23	(1.21-1.26)
*Also adjusted for the following: patient age, intractable pain, pulmonary acute care diagnosis group, urinary incontinence frequency, presence of urinary catheter, IV therapy, oxygen or ventilator use, receipt of injection medication, anxiety, behavioral problems, depression and associated symptoms, confusion, cognitive impairment, speech impairment, living arrangements, characteristics of non-agency assisting persons available, including patient has no one primary caregiver, need for any medication assistance, and HHA size. Final sample after omitting individuals with missing covariable values: 511,548				

**CHAPTER 3: The Impact of Home Health Agency Market Competition on
Risk for Hospital Readmission Among Post-Acute Care Medicare Home
Health Beneficiaries**

ABSTRACT

Objective. To quantify the impact of market competition on the quality of care provided by freestanding home health agencies (HHAs) to post-acute care Medicare home health beneficiaries and to determine if market competition differentially effects the quality of care being provided by for-profit and not-for-profit agencies.

Study Design and Data Sources. Retrospective cohort study of retrospective cohort study of non-institutionalized Medicare post-acute home health beneficiaries 65 years and older, admitted to freestanding HHAs from October 2003 to September 2004. Individual-level data were obtained from the Outcome Assessment Information Set (OASIS) for patients of HHAs identified as for-profit or non-for-profit in the Medicare Healthcare Cost Report Information System, linked with market level Medicare data from the Dartmouth Atlas and Medicare Provider of Service Files.

Principal Findings. Estimates from a three-level multilevel logistic regression, adjusted for market, agency and patient characteristics suggest that HHA competition (as measured by the Herfindahl index) does not affect patients' risk for rehospitalization and that the impact of profit status on rehospitalization risk is not altered by market competition.

Conclusions. Results suggest that variation in rehospitalization among free-standing HHAs, may be driven more by regional practice patterns and propensity to utilize inpatient care than by competition.

Key Words. Home health care, post-acute care, competition, markets

INTRODUCTION

In the last three decades the structure and relationships among providers in the healthcare market have been changing strikingly, with implications for the competitiveness of the post-acute home health care market. The implementation of hospital prospective payment in 1983 resulted in expanded demand for post-acute care services, in addition to hospital diversification into home health care¹⁹. Changes in Medicare policy instituted with the Omnibus Budget Reconciliation Act (OBRA) allowed for-profit HHA to participate in Medicare, resulting in the rapid proliferation of for-profit HHAs in the postacute care market. The implementation of HHA PPS in with the 1997 Balanced Budget Act resulted the exit of HHA from the market. Additionally, the healthcare market in general has been characterized by increasing vertical and horizontal integration of health care organizations positioning themselves to better compete and negotiate for resources^{76, 77}.

THEORY AND HYPOTHESES

Market Competition and Quality

When considering how market competition might impact health care quality, aspects of sociology's open-natural systems theories, including resource dependency, and contingency theory are useful. They address how organizations fit themselves to their environment and respond to uncertainty in their pursuit of key resources necessary to insure organizational survival^{15, 78}. Conceptually, highly competitive markets will have high levels of uncertainty. Higher competition has been associated with organizational

mortality⁷⁹. This analysis assesses the quality consequences of organizational decisions in pursuit of key resources and survival.

Encouragement of market competition in healthcare is regarded by many as a mechanism for containing costs and improving health care quality, while market concentration increases costs and reduces quality⁸⁰ however, evidence from empirical research is mixed. Competition has been associated with lower costs and prices⁷⁷, increased innovation^{3, 81} and reduced inpatient rehospitalization rates⁸² and market concentration associated with higher rates of poor outcomes among acute care hospitals^{83, 84}. However, some studies have shown higher rates of poor outcomes in more competitive hospital markets^{77, 83, 85}. While research among nursing homes has been mixed, finding poorer outcomes⁸⁶, and no association between competition and quality⁸⁷, nursing homes in competitive markets evidenced more improvement in publicly reported measures from 2002 to 2004 than was the case for facilities in less competitive markets⁸⁸. On the other hand, a recent study of health maintenance organizations found increased competition was not associated with better quality⁸⁹.

Little research, if any, has assessed the impact of market competition on HHA care quality. Analyses have focused on market influences on Medicare Home Health Benefit utilization^{23, 90, 91} or the effect of competition on HHA decisions to expand or contract service areas or enter or exit markets^{65, 92}. Porell found that these changes in HHA behavior happened more often in competitive markets. Increased market competition might be associated with poorer quality depending on strategies that agencies employ to survive, and depending on whether agencies risk losing hospital referrals if

they provide poorer quality care. Under highly competitive conditions where there are poorly informed consumers, agencies might, reduce costs by hiring lower-skilled workers, pressure employees to reduce visits or visit lengths (depending upon reimbursement), avoid providing, or reducing the availability of costly services, or under some circumstances be inclined to discharge costly patients. However, given a sector with informed consumers, organizations need to compete on quality, which should result in better outcomes for patients receiving care in competitive markets. All Medicare patients are required to receive discharge planning services, and therefore assistance in deciding on a post-acute provider, from their discharging hospitals. However, because of the fixed reimbursement rates of hospital PPS, hospitals have an incentive to discharge patients as quickly as possible causing a potential conflict of interest for the discharge planner. HHA in competitive markets may therefore feel pressure from hospitals to accept patients that the agency may not be prepared to handle. Agencies in non-competitive markets will have fewer consequences for providing poor quality care.

Hypothesis 1: Patients receiving care from HHA in competitive markets and in noncompetitive markets will have higher risks for rehospitalization than those in moderately competitive markets.

Market Competition and the Relationship between Profit Orientation and Quality

Evaluations of whether the effect of profit orientation on quality is modified by the organization environment are scant⁸. Institutional and ecological theory suggest that organizations tend to react to uncertainty in their environment by becoming more structurally and behaviorally similar^{93, 94}. Under high competition, for-profits and not-for-

profits may employ similar strategies to pursue scarce resources: patients and reimbursement. Nursing home studies looking at a variety of behaviors support this isomorphism hypothesis^{95, 96}. Additionally, it has been found that regardless of profit orientation, HHA in competitive markets are less likely to restrict admission criteria, or be as selective about the characteristics of patients they are willing to admit⁴¹. An alternative hypothesis is that for-profits and not-for-profits in competitive markets will have different levels of quality because organizations because for-profit agencies may be more vulnerable to resource restrictions in competitive markets. They must allocate funds for taxes and prioritize profit-maximization, limiting the availability of funds for quality improvement efforts and service innovation. While evidence is mixed for whether for-profit agencies were more likely to exit a HHA market during the initial phases of HHA PPS implementation compared to not-for-profits⁶⁵, there is evidence that for-profit agencies were more likely to reduce the size of their service area⁶⁵ and had proportionately larger reductions in the median length of patient stays^{24, 25}, supporting the notion that for-profit HHA may be more response to changes in their environments than not-for-profits. Both of these hypotheses (isomorphism and differential response to competition by profit orientation) suggest that the effect of profit orientation on risk for rehospitalization will differ by level of market competition for post-acute care patients.

Hypothesis 2: The effect of HHA profit orientation on risk for rehospitalization will differ by level of market competition for post-acute care patients.

Rehospitalization

Concern about the rate and associated cost of rehospitalization among Medicare funded home health patients has been growing^{6, 48}. The Office of the Inspector General reports that, from 2000 to 2004, 47% of Medicare home health beneficiaries starting a home health episode within 30 days of a hospital discharge are rehospitalized⁴⁹. Risk-adjusted agency-level rates of rehospitalization publicly reported by the Centers for Medicare and Medicaid Services (CMS) as a measure of HHA quality vary widely⁵⁰, suggesting that organizational-level differences may affect the quality of care provided. This indicator has been targeted for a nation-wide home health care quality improvement campaign⁶. Hospitalization rates have been used as indicators of health care quality in other settings including nursing homes³. Though some hospitalizations are necessary and may be a sign of good quality care, prior research suggests quality HHA care can reduce hospitalization⁵.

To date, no studies have assessed the impact of market competition on rehospitalization risk among post-acute care HHA patients. In this study we quantified the impact of market-level post-acute care competition on quality of HHA care as measured by patient rehospitalization within 60 days of home health admission. We also evaluated whether market competition has a differential impact on the quality of care being provided by for-profit and not-for-profit HHAs.

METHODS

Data Sources

We obtained individual-level data from the Outcome and Assessment Information Set (OASIS), submitted by agencies, as a condition of HHA participation in Medicare, to CMS on all HHA patients receiving Medicare or Medicaid funded home health care. OASIS data are used to adjust Medicare payments to account for differences in costs due to patients' severity, functional status and service needs⁵¹, for public reporting and other outcome-based quality improvement (OBQI) efforts. We obtained market level data on the availability of other types of post-acute care providers and address information used to assign HHAs to markets from the Medicare Provider of Service files.

We defined markets using Hospital Referral Regions (HRRs) as defined by *The Dartmouth Atlas of Health Care*. HRR are geographic areas that reflect the distribution of Medicare patients referred from local hospitals to regional facilities for major cardiovascular and neurological surgery and have been used extensively in health services research. HRRs are made up of smaller Hospital Service Areas, which are local markets for hospital care defined by aggregating ZIP code regions where the plurality of hospitalized Medicare patients in the ZIP code received their care in the same local hospital⁹⁷. Our use of the larger geographic unit in this analysis avoids convergence problems arising from small cell sizes when running regression analyses, and still reflects patterns of local hospital utilization. The use of HRRs improves on prior studies using state as a unit of analysis by more closely approximating markets where patients might reasonably choose among post-acute care providers. HRR are based on health care utilization patterns rather than political boundaries.

Agency profit status was obtained from the Medicare Healthcare Cost Reports Information System (HCRIS). Data are submitted by agencies to Fiscal Intermediaries as a condition of Medicare participation, are used for audits and to set prospective payment rates for subsequent periods⁵². These data have been used extensively to characterize health care providers^{53, 54}.

Sample

The sample includes all non-institutionalized Medicare post-acute home health beneficiaries 65 years and older admitted to a non-facility-owned HHA in the United States during the 12 months from October 2003 to September 2004. We identified post-acute patients as having had an acute care hospitalization within the 14 days prior to the HHA start of care assessment (39% of all start of care assessments). If an individual had more than one start of care assessment within the study period we selected one assessment at random for inclusion (approximately 2% of all individuals prior to applying agency-level restrictions). We excluded 200 agencies (serving 3% of post-acute patients) missing profit status data in the HCRIS and 330 agencies with a change in profit status reported between October 2000 and October 2005. Change in ownership may be a sign an agency is having financial problems, which may impact agency care quality⁸. While this group of HHA is of interest, there were too few of them to assess as a separate category. We excluded hospital-, and nursing home-owned HHAs from our analysis (1,803 agencies serving 26.8% of post-acute patients) hypothesizing that these strong linkages alter risk for rehospitalization by affecting incentives and quality of communication⁵⁵. Government-owned agencies made up a small proportion of HHAs in

the sample (n=298), serving a very small proportion of post-acute care patients (1.5%), therefore we excluded these HHAs. We also excluded individuals for whom we could not match a start of care assessment to a subsequent assessment to identify an outcome (n=54,013, 3.9% of post-acute patients, evenly distributed across HHA profit status). We restricted the sample further to exclude HHAs with fewer than 20 individuals (36.9% of HHAs serving 1% of post-acute patients). Doing so improved our ability to implement our modeling approach without convergence problems. Due to the small proportion (1.4%) of individuals with outcomes of death or transfer to a nursing home, rehabilitation, or skilled-nursing facility in our final sample we excluded individuals with these outcomes.

We further restricted our model to markets with 3 or more HHAs, also to avoid convergence problems (71 markets, 108 agencies serving 24,803 post-acute care patients). Our final sample of was 405,516 individuals receiving care from 2,590 HHA, located in 223 markets.

Determinant

To characterize competition from other HHA, we used the Herfindahl-Hirschman Index, a measure of market concentration widely used in empirical research investigating market competition⁹⁸⁻¹⁰⁰. The index is the sum of the square of the market shares of each firm in the market⁹⁸.

$$HI = \sum_{i=1}^n (s_i^2)$$

Where i indicates an individual HHA, s_i is market share of HHA_i , and n is the number of HHAs in the market. Market share, in this case, is the proportion of all post-acute Medicare Home Health Beneficiaries being served by an individual agency in the market, regardless of patient characteristics. The denominator is the count of start of care assessments for all post-acute care patients receiving care from an any agency located in the market, regardless of any patient- or agency-level characteristics and including hospital and nursing home owned HHAs. Values range from zero to one, with one indicating a monopoly and zero perfect competition. Of all the 7,197 US agencies with any Medicare Home Health Beneficiaries in the OASIS for our study year, we were able to match all but 105 to a HRR by zipcode using addresses from the Medicare Provider of Service File. Hypothesizing a non-linear effect, with higher risk of rehospitalization in highly competitive and in concentrated markets, we categorized the variable according to the US Department of Justice⁹⁸ thresholds as follows: below 0.1 (competitive), 0.1-0.18 (moderately competitive), above 0.18 (concentrated).

To investigate the impact of market competition on the quality of for-profit and not-for-profit HHA, we determined HHA profit orientation by matching the HCRIS file to OASIS using Medicare provider numbers. We combined levels to generate the exposure variable as follows: non-profit (including: voluntary church, voluntary other private); and for-profit (including: sole proprietor, partnership, corporation).

Outcome Measure

Conceptually, this study seeks to quantify occurrences of poor quality care by HHAs, operationally measured as any transfer to an acute care hospital from HHA care

within 60 days of admission to the HHA, except for transfers for planned surgery or chemotherapy⁵⁶. The majority (over 80%) of home health care discharges occur within 60 days of HHA admission²⁷, the length of a Medicare home health reimbursement episode. We used a dichotomous outcome comparing acute care hospitalization to a referent outcome including positive (to the community, admitted to hospice⁵⁷), or neutral discharge (e.g., moved, hospitalization for planned surgery or chemotherapy, etc.), or still receiving HHA services. To obtain length of service and outcomes, we matched Start of Care to Transfer or Discharge assessments using individual and agency unique identifiers and start of care dates, which are listed on all assessments. We then identified individuals' first discharge or transfer, or date of death. For patients admitted to an inpatient facility within 60 days, we identified type of facility from the Transfer assessment.

Potential Confounders

We reviewed the literature to identify market-, agency- and individual-level independent risk factors for hospitalization of home health patients. We evaluated these factors in bivariate and multivariate analyses described below to assess if they were confounders of the exposure-outcome relationship in our sample.

Market level: To account for potential competition from other types of post-acute care providers we considered skilled nursing facility (SNF), inpatient rehabilitation facility (IRF) and long-term care hospital (LTCH) beds per 1,000 Medicare enrollees^{65, 72} using data from the Medicare Provider of Service Files. A prior study suggests that post-acute patients with more severe conditions are more likely to receive care from SNFs or

LTCHs than IRFs or HHAs if they are present in the market⁷², potentially reducing the case-mix severity of the patient population of HHAs in the same market⁷². We considered beds for rural hospitals listing any swing beds in our SNF bed counts. We categorized these variables into three levels, corresponding to the bottom quartile, inter-quartile range and top quartile for ease of interpretability and to avoid forcing a linear relationship between the variables and our outcome. HHA utilization is reduced in markets where there are more nursing home beds^{72, 90, 91, 101}, IRF or LTCH beds⁷².

We hypothesized that the proportion of HHAs in a market owned by hospitals and skilled nursing facilities will impact the level of competitiveness for the free-standing HHAs and on patients' risk for rehospitalization. In particular, hospital-owned HHAs should be specially situated to compete for post-acute patients⁷². The presence of hospital- and SNF-owned HHAs might reduce the case-mix acuity of patients being provided services by free-standing HHAs. Data was not available to allow us to group HHAs that are members of chain together, but we did consider the percent of HHAs in a market with a branch or subunit, hypothesizing that HHAs with branches or subunits may be buffered from competitive pressures because they may be able to share resources and centralize some administrative functions. We included a variable indicating whether 50% or more of the HHAs in the market were for-profit, hypothesizing for-profit agencies located in markets dominated by not-for-profits may behave more like a not-for-profit to better compete for patient referrals^{96, 98}. Not-for-profit behavior may be similarly influenced by being located in a market dominated by for-profits.

Prior research looking at geographic variation health care costs in the US has found that regional differences in costs are not driven by any variation in patient clinical and service needs or by costs, but rather by availability and volume of services provided⁹⁷. This regional variation in service utilization might be a major factor in determining individual patient risk for hospitalization. We included two measures that characterize regional predisposition use health care. Wennberg suggests that intensity of regional practice patterns of care provided to Medicare patients at the end of life are highly correlated with care patterns of care provided to patients during other periods¹⁰². We therefore considered the percent of Medicare decedents hospitalized within the last six months of life as an indicator of regional tendency to utilize inpatient hospital services¹⁰². We also include Medicare hospital discharges per 1,000 Medicare enrollees⁹⁷. Increased hospital discharge rates, a measure of potential demand for post-acute care, have been associated with increased home health¹⁰¹ and other post-acute care⁷² utilization. We also included a measure of total Medicare reimbursements per enrollee (parts A and B), which is also an indicator of the volume of services being provided in the market, as regional spending has been found to be associated more strongly with service volume than local prices⁹⁷. Markets with higher reimbursement rates have been found to have more hospital utilization measured by more discharges, inpatient days and higher intensive-care unit admissions¹⁰³. All variables were categorized into three levels, corresponding to the bottom quartile, inter-quartile range and top quartile.

Agency-level factors: Larger agencies may have more resources for staff hiring, or development of specialized or comprehensive services⁶⁴. They may also be more

insulated from changes in market conditions and able to survive reductions in resource supplies⁶⁵. Alternatively, larger size might result in reduced administrative control and oversight or poor coordination of care. Some debate exists about how to quantify HHA size given the decentralized structure of HHAs^{12, 64}. We considered two different methods: 1) unduplicated counts of patients served and 2) counts of full-time equivalent staff and contract employees from the HCRIS. For the patient counts, we generated an unduplicated agency-level count of all individuals, regardless of referral source, with a start of care assessment during the study period. We also used these counts to calculate the percentage of all agency patients receiving post-acute care. Agencies with higher percent post-acute care may specialize in caring for hospital referrals, or have an unmeasured relationship with the referring hospital. All of these variables were categorized because distributions were not normal, to avoid forcing a linear relationship with hospitalization risk, and to improve interpretability of estimates. We also considered whether HHAs were urban or rural predicting that proportionately more for-profits HHA would be located in urban areas. Urban areas may have more financial resources available⁸, and better supplies of educated staff.

Individual-level: For individual-level confounders we focused on hospitalization risk factors, including demographic characteristics^{29, 59}, availability of other non-agency supports⁶⁰, and living arrangements⁶¹. We also considered whether patients had managed care versus fee-for-service coverage^{59, 62}. For functional status, we calculated a scaled composite disability score (with a range of 0 to 13) summarizing need for assistance in eight activities of daily living (ADLs) and five instrumental activities of daily living

(IADLs), excluding telephone use because of missing values. For ease of interpretability and to avoid imposing a linear relationship to readmission risk, we categorized the variable to whole number values that approximate quartiles of the distribution, with additional categories subdividing the upper end of the disability scale where we anticipated the largest effect. We also included an indicator of any need for medication administration assistance as another indicator of functional disability³³.

Clinical characteristics we evaluated include urinary incontinence, presence of a urinary catheter, an indicator of any bowel incontinence or ostomy, intractable pain, and dyspnea^{33, 59}, integumentary status³³. We also considered acute and home health diagnoses grouped into categories used for home health case-mix and risk adjustment measures by CMS⁶³. We included severity of an individual's most problematic HHA admitting diagnosis³³ and receipt of any injection medications. Ventilator use⁵⁹ was very small (0.05%) so we created a combined indicator with oxygen therapy³³. We also included indicators for presence of enteral or parenteral nutrition therapy³³, intravenous therapy at admission^{33, 59}, and good rehabilitation prognoses^{33, 59}. For cognitive and emotional status we included confusion⁵⁹, anxiety, depression⁵⁹ or any associated symptoms, and behavioral problems⁵⁹.

Analytic Approach

We conducted bivariate comparisons to assess potential confounding by the above individual, agency and market characteristics. Variables that appeared unbalanced across agency profit status, we considered as candidate variables in our subsequent model building. We conducted three-level multilevel logistic regression analyses, accounting for

the clustering of individuals within agencies. Individuals within an agency are likely to have similar clinical and demographic characteristics and be exposed to similar agency organizational policies and care practices. Clustering of agencies within a market is also likely, due to exposure to the same population and market factors. If sources of clustering are not accounted for, coefficient estimates may be biased and standard errors underestimated. This analysis is best explained using three separate models, one for each level. The patient-level model is:

$$(i) \text{Log} \left(\frac{P_{rehospitalization}}{P_{NeutralDischarge}} \right) = b_{0ijk} + \mathbf{b}_{ijk} \text{Individual Level Confounders}$$

where i =patient and j =HHA, within k =market.

The agency-level model is:

$$(ii) b_{ljk} = g_{l0k} + g_{l1k} \text{profitorientation} + \mathbf{g}_{lk} \text{Agency Level Confounders} + E_{ljk}$$

Where b_{ljk} is the l 'th regression coefficient for agency j within market k from the first level model and E_{ljk} is an agency-level error term. This model assumes that individual-level variation in risk for rehospitalization has a systematic component attributable to characteristics of the HHA. The **market-level** model is:

$$(iii) g_{lmk} = d_{lm0} + d_{lm1} \text{Competitive} + d_{lm2} \text{NonCompetitive} + \mathbf{d}_{lmk} \text{Market Level Confounders} + U_{lmk}$$

Where g_{lmk} is the lm 'th regression coefficient for market k from the second level model.

Index l has a range equivalent to the number of coefficients in level 1 (equation i). The

index m has a range equivalent to the number of coefficients in level 2 (equation ii). U_{lmk} is a market-level error term.

These models can be combined:

$$(iv) \text{Log} \left(\frac{P_{rehospitalization}}{P_{neutral discharge}} \right) = R_{ijk} + F_{jk} + S_k + E_{0j} + U_{00k}$$

Where R_{ijk} is the linear predictor of patient effects, F_{jk} is the linear predictor of agency effects, S_k is the linear predictor of market effects, and E_{0j} accounts for random variation at the agency level and U_{00k} variability at the market level. This is a random intercept value which assumes facility and market variability. The odds ratio for the effect of a competitive market is calculated by taking $e^{d_{competitive}}$, and interpreted as follows: *The odds of rehospitalization for individuals cared for by an agency in a competitive market are N times the odds for individuals cared for by an agency in a moderately competitive market.*

We first ran a crude analysis of the impact of market competition on rehospitalization, controlling for clustering at the agency- and market-levels, then evaluated potential confounders in an iterative process. If a variable, when entered individually into the model, changed the coefficient estimates for either highly competitive or concentrated markets by more than five percent we considered it a confounder and retained it in the model⁶⁶. Bivariate analyses were conducted using SAS (Version 9.1, SAS Institute, Inc., Cary, NC), and multilevel using the GLLAMM procedure in STATA (Version 10.0, StataCorp, College Station, TX). Speculating that the impact of market competition would be different for for-profit agencies and not-for-

profits, we conducted a stratified analyses looking at the impact of profit orientation on rehospitalization by level of market competitiveness.

RESULTS

Market-level bivariate results: The supply of beds per enrollee for SNFs and rehabilitation facility appear to increase with increasing HHA market competition (Table 1a) while there are more long-term care hospital beds per enrollee in concentrated markets. While the market-level median percentages of HHA that are for-profit are equivalent across competition, it appears that fewer moderately competitive markets are majority for-profit than either low or high competition markets. At the same time, concentrated markets appear to have proportionately fewer facility-owned HHA and fewer agencies with a branch or subunit. Markedly more Medicare patients were hospitalized in their last six month in high competition markets while rates are similar in moderate and low competition markets. Similarly, high competition markets were likely to have more discharges per Medicare enrollee. Total Medicare reimbursement rates per enrollee were higher in high and low competition markets than moderately competitive markets.

Agency-level bivariate results: Not surprisingly, highly competitive markets have proportionately more small agencies (Table 1b), based on count of patients, or of full-time equivalent employees (either staff or contract). Of our study sample, eighty-five percent of agencies in highly competitive markets are for-profit compared to 68% and 74% in moderate and low competition markets respectively. Agencies do not appear to

vary systematically across market competition when looking at percent of clients served who are post-acute patients. Agencies in concentrated markets appear to be more often located in urban locations.

Patient-level bivariate characteristics:- The median agency-level proportion of patients rehospitalized for the study sample during the study period was 17.0% with a range from 0 to 50%. Patients of agencies in highly competitive markets were rehospitalized within 60 days of HHA admission at a risk of 16.5% (Table 1c) only slightly higher than the risk for patients in moderate (16.1%) and low (16.0%) competition markets. Patients were largely very similar on the clinical, demographic, functional and assistance variables we considered. Patients receiving care from agencies located in high competition markets had slightly higher disability scores, and more severe dyspnea. Patients in moderately competitive markets had better rehabilitation prognoses than those in highly competitive or in concentrated markets.

Regression results: Results of our crude three-level model (Table 4) suggest that patients receiving care from HHA in highly competitive markets are more likely to be rehospitalized than those receiving care from HHA in moderately competitive markets (OR: 1.06, 95% Confidence Interval:0.99 to 1.14). The same model suggests that patients in concentrated markets are slightly less likely to be rehospitalized (OR:0.98, 95% Confidence Interval:0.90 to 1.06). Neither of these results were statistically significant, however. This is further reflected in our adjusted model where no difference in in rehospitalization risk across competition could be discerned (Table 5) (Competitive Market OR: 0.98, 95% CI: 0.93-1.03; Concentrated Market OR:1.02, 95% CI: 0.96-1.09).

These estimates reflect adjustment for the following variables we identified as confounders: disability, dyspnea, urban location of HHA, and at the market-level, the percent of HHA in the market that were facility owned and the number of all Medicare hospital discharges per 1,000 Medicare enrollees. We did not see a difference in the impact of HHA profit status on rehospitalization risk across levels of market competition (Table 6) adjusting for additional confounders of the profit – rehospitalization relationship (HHA admission diagnosis groups, and percent of patients in HHA who are receiving post-acute care).

DISCUSSION

Our findings do not support our hypothesis that post-acute Medicare home health beneficiaries receiving care from free-standing HHAs in highly competitive and concentrated markets are at increased risk for rehospitalization compared to patients of HHAs in moderately competitive markets. While our crude estimates showed higher odds of rehospitalization for competitive markets (OR: 1.06, 95% CI: 0.99-1.44) and no difference for concentrated markets (OR: 0.98, 95% CI: 0.90-1.06), the effect of competitive markets dissipated after controlling for the few individual-, agency- and market-level characteristics identified in the multivariate analyses as confounders. Furthermore, controlling for whether the majority of HHAs in the market were for-profit had no effect on our estimate of the effect of market competition. We also found that the effect of HHA profit status on patient odds of rehospitalization did not differ as a function of market competitiveness.

We found little confounding by individual-level characteristics, consistent with our bivariate results which only indicated differences by market competition in the distribution of patients with severe dyspnea and disability and by rehabilitation prognosis. While the percent of HHAs in the market that are facility owned had the biggest initial impact on our competition estimate when added to the model, the effect of this variable on rehospitalization disappeared once we controlled for other variables. We found that patients living in markets with more Medicare hospital discharges per 1,000 Medicare enrollees were more likely to be rehospitalized and that this variable accounts for a portion of the market-level variation in rehospitalization by competition. This finding is consistent with prior work suggesting that regional variation in health care utilization is determined more by regional practice patterns than by variation in patient-level severity⁹⁷.

It is possible that characteristics of post-acute care and home health may make competition irrelevant to quality. Patients and their families may find it difficult to make informed decisions at the time of hospital discharge, diminishing the need for HHAs to compete on quality for referrals. Additionally, if discharge planners are more likely to serve the needs of the hospital to discharge patients as quickly as possible, or if hospitals do not put resources into sufficient personnel to adequately serve patients' needs for discharge planning services, the need for HHA to compete on quality is also undermined. Alternatively, HHAs may be competing by meeting other patient preferences, e.g. specialized services, which may not be relevant to rehospitalization. It is possible that

other quality measures such as, patient satisfaction, or improvement on patient clinical and functional measures, may still be influenced by competition.

Institutional theory applied to health care organizations provides an explanation for our finding that for-profit and not-for-profit HHAs behave similarly regardless of market competition. In agencies efforts to survive in a sector marked by a lot of change across all markets, including changes in patient eligibility for the Medicare home health benefit, and major changes in Medicare reimbursement, they may respond similarly mimicking actions of other health care organizations, in an attempt to survive, in a process of isomorphism^{8, 14, 16, 17, 41}. Many have commented on the increasingly fuzzy distinction between for-profit and not-for-profit health care organizations, and observed general shifts in health care management culture to emphasize competition and strategy⁶⁹. An alternative but congruent explanation may be that there is little regulation of not-for-profit HHA compliance with non-distribution constraints imposed on not-for-profits, coupled with a poorly informed set of consumers resulting in a sector where HHAs can operate as ‘not-for-profit’s in name only without consequences, behaving otherwise as for-profits might⁷⁰.

Limitations

It is possible that there are other factors relevant to the competitiveness of the post-acute care market that we have not included in our study. It is not currently possible to adequately identify which HHAs are members of the same chain⁷², as a result there may be markets that are highly competitive according to the Herfindahl Index, but may be made of many small agencies that are members of the same chain. Markets with

chains may in fact be much more similar to concentrated markets than is represented in our HHI measure. Chain members may also be more sheltered from the effects of market competition. The error introduced by not being able to account for clusters of chains in the HHI is somewhat mitigated by identifying the proportion of HHAs in a market that have subunits or branches. Additionally, prior research suggests that HHA do not benefit by economies of scale sometimes associated with larger organizations⁷³. The local supply of primary care physicians and nurse aides may also impact agencies' ability to provide quality health care. Some agencies may be better prepared to compete for staff. Market shortages of health professionals may have an overall negative effect on patient outcomes. As a strength, we have thoroughly considered other formal sources of competition (e.g. SNFs) for post-acute care patients, which might also influence the availability of quality physician, nurses and other workforce for HHAs. Furthermore, our decision to keep these other sources of post-acute care separate from our competition measure is appropriate as prior research has shown that these settings are not perfect substitutes although characteristics of patients do overlap⁷².

Other relevant market characteristics that we have not accounted for may include the local market capacity for informal caregiving, which could be measured by the proportion of women active in the workforce. Not considering these other factors may introduce non-differential misclassification into my analysis, biasing the measure of effect towards the null. We have not included a measure of managed care penetration in this analysis; which may also act to increase competitiveness by pressuring HHA to reduce costs and improve efficiency. However, rates of coverage at the individual-level in

our sample suggest that managed care may not have been a large presence in the HHA market during our study year.

It is also possible that HRRs may not be the appropriate unit of analysis to define home health agency markets. It is likely that this would introduce non-differential misclassification into the analysis and therefore bias the estimate towards the null. However, because HRRs are based on actual patient acute care utilization patterns, they present an improvement on other market definitions used previously that are dependent on political boundaries like state. Additionally, a criticism of the Herfindahl-Hirschman Index is that it does not give a complete picture of market structure. Not reflected in the measure is an individual agency's position relative to the rest of the market. A small agency in a highly concentrated market with another very large agency may be experiencing constraints on its resources due to the competitive advantage of the larger agency, which could impact its behavior, resource allocation choices including patient care, analogous to the experiences of another agency in a more competitive, unconcentrated market. We did, however, consider two measures of size (patient count, and count of full-time equivalent employees) and did not find they affected our estimates.

Other potential non-causal explanations for our findings are that there are unmeasured individual-level characteristics impacting risk for rehospitalization including stress, life satisfaction, and therapy compliance^{46, 104}, education¹⁰⁴ and unmeasured caregiver attributes related to the ability to support the patient in the community²⁸. However, the lack of strong confounding by measured patient and caregiver characteristics in our analysis minimize these concerns. Differences by market

competition in unmeasured physician and hospital characteristics may influence variation in patient outcomes. Poor communication of care plans and patient information between the hospital and agency during transition could also result in higher patient risks. However, clustering at the HRR should control for some of these unmeasured market characteristics.

Conclusion

Findings from the current analysis suggest that competition does not influence the quality of care provided to post-acute care patients by free-standing HHA even when accounting for agency profit status. Our study adds to the literature by looking at HHA market and organizational characteristics and their relationship to quality. Our study also accounts for clustering at both the market- and agency-level, in addition to confounders at these levels. The OASIS data set is a Census of Medicare home health beneficiaries and as yet not yet widely used. We also considered the possible role of the availability of other post-acute care providers and regional practice patterns on patient risk for rehospitalization

Our results suggest that variation in rehospitalization among HHA, particularly free-standing agencies, may be driven more by regional practice patterns and propensity to utilize inpatient care than by competition. This may have implications for efforts to improve home health care quality through mechanisms that encourage competition on quality such as public reporting and pay-for-performance.

TABLES

Table 3.1a: Market Characteristics by Market Level of HHA Competition

		Moderately	Non-
	Competitive	Competitive	Competitive
<i>Market Characteristics</i>	(HI:<0.10)	(0.1<=HI<0.18)	(HI>=0.18)
Count of markets:	77	79	67
Count of agencies:	1528	695	367
Count of patients:	242307	151464	101745
Median number of agencies in sample	15	7	4
<i>Competition: other post-acute care providers</i>			
Medicare SNF beds per 1,000 enrollees	47 (17)	46 (17)	40 (18)
up to 26	2.6	7.59	13.43
27 to 40	31.17	30.38	38.81
41 or more	66.23	62.03	47.76
Medicare Rehab Facility beds per 1,000 enrollees	1.3 (1.0)	1.3 (0.8)	1.2 (0.7)
<=0.77	11.69	29.11	34.33
>.77 to 1.74	55.84	48.1	46.27
1.74+	32.47	22.78	19.4
Medicare LTC hospital beds per 1,000 enrollees	1.0 (3.5)	0.9 (2.6)	1.7 (1.7)
1	40.26	34.18	10.45
2 to 3	35.06	15.19	19.4
more than 3	24.68	50.63	70.15
<i>Other Market Characteristics</i>			

Profit status % of HRR where Majority of

HHA in market are for-profit	57.14	39.24	59.7
------------------------------	-------	-------	------

Percent of HHA in Market that are facility

owned	26.3 (16.6)	25.0 (16.4)	25.0 (25.8)
-------	-------------	-------------	-------------

<25%	45.45	48.1	46.27
------	-------	------	-------

25% up to 40%	31.17	30.38	37.31
---------------	-------	-------	-------

40% and up	23.38	21.52	16.42
------------	-------	-------	-------

Percent of HHA with a Branch or Subunit	20.5 (10.7)	22.2 (12.7)	19.2 (14.9)
---	-------------	-------------	-------------

<10%	18.18	17.72	28.36
------	-------	-------	-------

10% up to 20%	31.17	31.65	28.56
---------------	-------	-------	-------

20% or more	50.65	50.63	43.28
-------------	-------	-------	-------

Utilization

Percent of Medicare decedents hospitalized

within last six months of life	72.8 (4.4)	70.3 (4.3)	70.9 (3.9)
--------------------------------	------------	------------	------------

65% or less	6.49	8.86	10.45
-------------	------	------	-------

over 65% up to 75%	66.23	78.48	76.12
--------------------	-------	-------	-------

75% or more	27.27	12.66	13.43
-------------	-------	-------	-------

Medicare hospital discharges per 1,000

enrollees	225 (42)	236 (38)	234 (44)
-----------	----------	----------	----------

200 or less discharges	9.09	15.19	28.36
------------------------	------	-------	-------

between 200 and 270 discharges	57.14	65.82	50.75
--------------------------------	-------	-------	-------

270 or more discharges	33.77	18.99	20.9
------------------------	-------	-------	------

Total Medicare reimbursements per enrollee	7,264 (1,319)	6952 (968)	7215 (1,076)
--	---------------	------------	--------------

<\$6,600	19.48	35.44	20.9
----------	-------	-------	------

\$6,600 up to \$8,000	54.55	45.57	49.25
-----------------------	-------	-------	-------

\$8,000 and up	25.97	18.99	29.85
----------------	-------	-------	-------

Table 3.1b: Agency Characteristics by Market Level of HHA Competition

		Moderately	Non-
	Competitive	Competitive	Competitive
Organizational Characteristics	(HI:<0.10)	(0.1<=HI<0.18)	(HI>=0.18)
Count of agencies:	1528	695	367
<i>Profit Orientation</i>			
For profit	85.9	68.1	73.8
Not-for-profit	14.1	31.9	26.2
Size (count of patients) – median (std)	207 (550)	272 (738)	307 (1586)
small (<100)	19.8	13.7	12.5
medium (100-199)	28.9	25.3	24.0
large (199-499) (ref)	31.4	32.4	30.3
very large (500+)	19.8	28.6	33.2
Total Visits*– median (std)	14,686 (42,924)	16,952 (44,967)	18,793 (24,3528)
Q1:<=20,600	61.4	56.6	53.6
Q2: over 20600 to 42500	22.4	23.9	24.9
Q3: over 42500 to 101150	11.1	13.7	14.5
Q4: over 101150	5.0	5.8	7.0
<i>Full-Time Equivalent Employees* –</i>			
median (std)	20.5 (8,285.2)	25.3 (951.5)	26.5 (2,743.0)
Q1: <=12	27.1	20.3	23.2
Q2: over 12 to 22	26.2	24.5	20.7
Q3: over 22 to 45	24.5	26.4	23.2
75ile: over 45 to 98	13.5	15.9	20.4
90ile: over 98	8.6	13.0	12.6

<i>Visits per Patient* – median (std)</i>	27.0 (37.5)	23.8 (50.5)	22.3 (44.4)
Q1: <12.4	6.1	6.4	9.5
Q2: 12.5 to 20	22.5	31.2	31.4
Q3: over 20 to 30	28.4	27.5	29.4
Q4: over 30	43.0	34.9	29.7
<i>% Post-acute Care – median (std)</i>	53.5 (14.4)	58.5 (14.2)	56.0 (16.3)
<43.6%	26.9	21.4	27.8
43.6-55.1	27.5	23.3	19.9
55.1-64.5	23.6	28.6	21.5
64.5-72.5	13.2	16.7	16.9
72.5+	8.8	9.9	13.9
<i>Urban location</i>	77.4	76.0	86.7

Missings: Visits and full time equivalent employees - 46 agencies serving 2,223 patients;

visits per patient - 66 agencies serving 5,708 patients.

Table 3.1c: Patient Characteristics by Market Level of HHA Competition

	High	Moderate	Low
	Competition	Competition	Competition
Characteristic	(HI:<0.10)	(0.1<=HI<0.18)	(HI>=0.18)
Count of patients:	242307	151464	101745
Readmissions	16.5	16.1	16.0
Length of stay (days) - median (std)	24 (18.1)	23 (17.5)	23 (17.4)
<i>Demographics</i>			
female	59.4	58.7	59.8
Age - median (std)	77.4 (7.4)	77.6 (7.3)	77.7 (7.4)
1= 65-74	38.9	37.7	37.3
2=75-84	43.9	44.8	44.2
3=85+	17.2	17.5	18.5
managed care	10.6	14.9	11.5
<i>Disability</i>			
Disability - median (std)	5.1 (2.0)	4.8 (2.0)	5.0 (2.0)
<3	16.5	20.3	16.7
3-4	14.9	16.9	15.4
4-5	16.8	17.7	17.9
5-6	19.7	18.3	19.4
6-7	16.4	14.4	15.9
7-9	12.8	10.0	11.5
9+	3.3	2.5	3.2
Any medication assistance needed (y/n)	51.4	50.0	50.2
Receiving injection Medications	14.0	14.1	14.0

Clinical

Integumentary status

no lesion, pressure or stasis ulcer or

surgical wound	32.9	30.6	34.9
----------------	------	------	------

lesion with no pressure or stasis ulcer or

surgical wound	17.2	18.2	16.1
----------------	------	------	------

surgical wound (observable only)

45.1	46.6	44.0
------	------	------

any pressure or stasis ulcer

4.8	4.6	4.9
-----	-----	-----

Dyspnea

never (ref)	33.8	35.2	40.5
-------------	------	------	------

walking >20 ft	25.5	27.9	27.1
----------------	------	------	------

moderate exertion	24.7	22.5	20.3
-------------------	------	------	------

at rest or with minimal exertion	16.0	14.4	12.1
----------------------------------	------	------	------

Highest Severity HHA diagnosis

asymptomatic/well controlled (ref)	1.6	1.8	1.7
------------------------------------	-----	-----	-----

controlled with difficulty	61.2	60.4	63.3
----------------------------	------	------	------

poorly controlled	32.0	32.6	30.1
-------------------	------	------	------

history of rehospitalization	5.2	5.3	4.8
------------------------------	-----	-----	-----

Intractable Pain	12.5	13.8	11.4
------------------	------	------	------

Bowel incontinence or ostomy indicator	9.1	8.7	8.4
--	-----	-----	-----

Acute Care Diagnosis Group

Orthopedic	30.2	29.6	29.8
------------	------	------	------

Neurologic	7.5	7.2	7.5
------------	-----	-----	-----

Cardiac	29.8	31.8	31.2
---------	------	------	------

Home Health Agency Admission Diagnosis

Group

cancer	10.9	11.8	12.0
circulatory	53.7	54.7	54.7
endocrine	24.8	25.2	24.8
musculoskeletal	30.7	29.3	29.6
respiratory	17.7	18.8	17.6
Catheter/Urinary Continence Frequency			
never (ref)	72.1	72.2	75.9
timed voiding defers or at night only	7.1	7.5	7.2
during the day and night	16.8	16.2	12.9
catheterized	4.0	4.1	4.0
Enteral or Parenteral Nutrition Therapy,			
receiving	1.5	1.3	1.5
IV Therapy (y/n)	2.2	2.1	2.1
Respiratory Tx (O2 or Ventilator (y/n)	12.0	12.9	11.3
Behavioral problems (y/n)	15.5	14.5	13.2
Depression and associated symptoms	16.9	16.1	14.9
Confusion			
Never	65.7	66.3	67.8
In new or complex situations only	26.3	26.4	25.1
On awakening or at night only	1.3	1.1	1.0
During the day and evening or constantly	6.7	6.2	6.1
Anxiety			
None	64.0	63.5	67.2
Less than daily	21.3	21.3	19.6
Daily or constantly	14.7	15.3	13.2
Any speech impairment	23.7	23.5	22.2

Rehab Prognosis	85.1	94.1	84.3
<i>Assistance & Living Arrangements</i>			
Living arrangements			
lives with spouse	43.4	44.5	41.5
lives with any others	31.4	27.9	31.2
Lives alone	25.2	27.6	27.3
Has no one caregiver	16.0	15.8	16.4
Assisting person other than agency (characteristics)			
Comes in from outside home (unpaid)	29.5	31.8	31.5
Resides in home (unpaid)	66.2	65.0	63.5
Paid help (residing in home or coming from outside home)	2.1	1.4	2.4
None of the above	2.2	1.8	2.7

*Missings: no one caregiver - 509; assisting person other than agency - 327; confusion - 583; anxiety - 1507; rehabilitation prognosis – 6203

Total N: 495516

Table 3.2: Crude Estimates of Association Between Market Competition and Rehospitalization

Variable	Crude OR	95% CI
Market Characteristics		
HHA Competition (Herfindahl-Hirschman Index)		
High Competition (HI:<0.10)	1.06	(0.99-1.14)
Moderate Competition (0.1<=HI<0.18)		
Low Competition (HI>=0.18)	0.98	(0.90-1.06)
% of HHA in Market that are Facility Owned		
<25%	1.00	
25% up to 40%	0.90	(0.86-0.94)
40% and up	1.05	(0.99-1.10)
% of HHA in Market with a Branch or Subunit		
<10%	0.88	(0.82-0.95)
10% up to 20%	0.94	(0.91-0.98)
20% or more	1.00	
Majority of HHA in Market are For-profit	0.87	(0.84-0.90)
SNF beds per 1,000 Medicare Enrollees		
up to 26	0.84	(0.76-0.93)
27 to 40	0.86	(0.82-0.91)
41 or more	1.00	
IRF beds per 1,000 Medicare Enrollees		
<=0.77	0.77	(0.73-0.82)
>.77 to 1.74	0.82	(0.79-0.86)
1.74+	1.00	
LTCH beds per 1,000 Medicare Enrollees		

Variable	Crude OR	95% CI
1	1.04	(0.94-1.14)
2 to 3	1.13	(1.07-1.19)
more than 3	1.00	
Total Medical Discharges per 1, 000 Medicare enrollees		
200 or less discharges	0.64	(0.60-0.68)
between 200 and 270 discharges	0.88	(0.85-0.91)
270 or more discharges	1.00	
% of Deceased Medicare Beneficiaries Hospitalized in last 6 Months of Life		
65% or less	1.00	
over 65% up to 75%	1.20	(1.08-1.34)
75% or more	1.41	(1.26-1.56)
Medicare Reimbursement per beneficiary		
<\$6,600	0.90	(0.86-0.94)
\$6,600 up to \$8,000	0.97	(0.94-1.01)
\$8,000 and up	1.00	
Agency Characteristics		
Size (count of individual patients served)		
small (<100)	1.10	(1.04-1.16)
medium (100-199)	1.00	
large (199-499) (ref)	1.07	(1.03-1.12)
very large (500+)	0.92	(0.89-0.96)
Total Visits Reported		
Q1: <=20,600	1.06	(1.01-1.12)
Q2: over 20600 to 42500	1.04	(0.98-1.10)
Q3: over 42500 to 101150	0.97	(0.91-1.03)

Variable	Crude OR	95% CI
Q4: over 101150	1.00	
Full-time equivalent employees (staff and contract)		
Q1: <=12	1.10	(1.04-1.16)
Q2: over 12 to 22	1.05	(1.00-1.11)
Q3: over 22 to 45	1.05	(1.00-1.10)
75ile: over 45 to 98	1.02	(0.97-1.07)
90ile: over 98	1.00	
Visits per patient		
Q1: <12.4	0.81	(0.76-0.86)
Q2: 12.5 to 20	0.88	(0.84-0.92)
Q3: over 20 to 30	0.92	(0.88-0.95)
Q4: over 30		
Post-acute care - % of agency start of care assessments		
<43.6%	1.09	(1.04-1.14)
43.6-55.1	1.07	(1.03-1.12)
55.1-64.5	1.00	
64.5-72.5	0.94	(0.90-0.98)
72.5+	0.90	(0.86-0.94)
Urban Location	0.90	(0.87-0.94)
Individual Characteristics		
Female	0.82	(0.81-0.83)
Age (years)		
65-74	1.00	
75-84	1.09	(1.07-1.11)
85+	1.23	(1.21-1.26)

Variable	Crude OR	95% CI
Managed care	0.84	(0.81-0.86)
Disability		
<3	1.00	
3-4	1.13	(1.09-1.16)
4-5	1.24	(1.20-1.27)
5-6	1.37	(1.33-1.41)
6-7	1.78	(1.73-1.83)
7-9	2.67	(2.60-2.75)
9+	4.34	(4.17-4.52)
Any medication assistance needed (y/n)	1.99	(1.96-2.02)
Receiving injection Medications	3.48	(3.39-3.58)
Integumentary Status		
no lesion etc (ref)	1.00	
lesion with no pressure ulcer/stasis ulcer/surgical wound	1.10	(1.08-1.13)
surgical wound (observable only)	0.60	(0.59-0.61)
any pressure ulcer or stasis ulcer	1.72	(1.67-1.78)
Dyspnea		
never (ref)	1.00	
walking >20 ft	1.38	(1.35-1.41)
moderate exertion	1.93	(1.89-1.97)
at rest and with minimal exertion	2.99	(2.92-3.06)
Highest Severity Home Health Admission diagnosis		
asymptomatic/well controlled (ref)	0.70	(0.65-0.75)
controlled with difficulty	1.00	
poorly controlled	1.36	(1.34-1.39)

Variable	Crude OR	95% CI
history of rehospitalization	1.86	(1.80-1.93)
Intractable Pain	1.13	(1.11-1.16)
Bowel incontinence or ostomy indicator	1.90	(1.86-1.95)
Acute Care Diagnosis Group		
Cardiac	1.41	(1.38-1.43)
Orthopedic	0.40	(0.40-0.41)
Respiratory	1.57	(1.54-1.60)
Home Health Admission Diagnosis Group		
cancer	1.75	(1.72-1.79)
circulatory	1.37	(1.35-1.39)
endocrine	1.34	(1.31-1.36)
musculoskeletal	0.74	(0.72-0.75)
respiratory	1.51	(1.48-1.54)
Catheter/Urinary Continence Frequency		
never (ref)	1.00	
timed voiding defers or at night only	1.17	(1.14-1.21)
during the day and night	1.47	(1.44-1.50)
catheterized	1.70	(1.64-1.76)
Enteral or Parenteral Nutrition Therapy, receiving	2.50	(2.38-2.63)
IV Therapy (y/n)	1.55	(1.48-1.62)
Respiratory Tx (O2 or Ventilator (y/n)	1.96	(1.92-2.00)
Behavioral problems (y/n)	1.51	(1.48-1.54)
Depression and associated symptoms	1.53	(1.50-1.56)
Confusion		
Never		

Variable	Crude OR	95% CI
In new or complex situations only	1.73	(1.35-1.40)
On awakening or at night only	1.67	(1.69-1.91)
During the day and evening	1.72	(1.67-1.78)
Constantly	1.76	(1.66-1.88)
Anxiety		
None		
Less than daily	1.29	(1.27-1.32)
Daily to all the time	1.58	(1.54-1.61)
Speech		
no impairment (ref)	1.00	
any impairment	1.58	(1.55-1.60)
Rehab Prognosis	0.42	(0.41-0.42)
<i>Assistance & Living Arrangements</i>		
Living arrangements		
Lives with spouse (ref)	1.00	
Lives Alone	0.90	(0.89-0.92)
Lives with any others (non-spouse)	1.22	(1.19-1.24)
Has no one caregiver		
Assisting person other than agency (characteristics)		
Comes in from outside home (unpaid)	0.88	(0.86-0.89)
Resides in home (unpaid) – (ref)	1.00	
Paid help (residing in home or coming from outside home)	1.02	(0.97-1.08)
None of the above	0.76	(0.72-0.81)

Table 3.3: Adjusted Estimates of Association Between Market Competition and Rehospitalization

(restricted to only confounding variables)

	Adjusted OR	95% CI
Market Competition		
Competitive	0.98	(0.93-1.03)
Moderately Competitive	1.00	
Concentrated	1.02	(0.96-1.09)
Percent of HHA in market that are facility owned		
<25%	1.00	
25% up to 40%	0.97	(0.93-1.02)
40% and up	1.00	(0.94-1.07)
Total Medicare hospital discharges per 1,000 enrollees		
200 or less discharges	0.73	(0.68-0.79)
between 200 and 270 discharges	0.93	(0.88-0.97)
270 or more discharges		
Urban location	0.95	(0.91-0.98)
Disability (scaled, categorized score - combines ADL & IADL)		
<3, (ref)	1.00	
3-4	1.08	(1.05-1.12)
4-5	1.17	(1.14-1.21)
5-6	1.27	(1.24-1.31)
6-7	1.58	(1.54-1.63)
7-9	2.25	(2.19-2.32)
9+	3.74	(3.59-3.9)
Dyspnea		

never (ref)	1.00	
walking >20 ft	1.42	(1.39-1.45)
moderate exertion	1.82	(1.78-1.86)
at rest or with minimal exertion	2.61	(2.55-2.67)

Table 3.4: Adjusted Estimates of Association Between Profit Orientation and Rehospitalization by Market Competition, Parsimonious Model plus Variables of Interest

	Adjusted OR	95% CI
Market Competition		
Competitive	1.00	(0.96-1.05)
Moderately Competitive	ref	
Concentrated	1.02	(0.96-1.07)
SNF beds per 1,000 Medicare Enrollees		
up to 26	1.00	(0.91-1.09)
27 to 40	1.03	(0.98-1.07)
41 or more	ref	
% of HHA in market that are facility owned		
<25%	ref	
25% up to 40%	0.99	(0.95-1.04)
40% and up	0.99	(0.92-1.06)
Total Medicare hospital discharges per 1,000 enrollees		
200 or less discharges	0.73	(0.68-0.79)
between 200 and 270 discharges	0.92	(0.88-0.96)
270 or more discharges	ref	
Majority of HHA in Market are For-profit	1.01	(0.96-1.06)
Urban location	0.95	(0.92-0.99)
Agency is For-profit	1.01	(0.97-1.04)
Disability (scaled, categorized score - combines ADL & IADL)		
<3	ref	
3-4	1.12	(1.09-1.15)

	Adjusted OR	95% CI
4-5	1.24	(1.2-1.27)
5-6	1.37	(1.33-1.4)
6-7	1.70	(1.66-1.75)
7-9	2.41	(2.34-2.48)
9+	4.00	(3.84-4.17)
Dyspnea		
never	ref	
walking >20 ft	1.32	(1.29-1.35)
moderate exertion	1.62	(1.58-1.66)
at rest or with minimal exertion	2.19	(2.13-2.25)
Home Health Admission Diagnosis Group		
cancer	1.80	(1.76-1.84)
circulatory	1.32	(1.29-1.34)
endocrine	1.26	(1.24-1.29)
musculoskeletal	0.83	(0.82-0.85)
respiratory	1.20	(1.18-1.23)

	Moderate					
	Competitive		Competition		Concentrated	
	OR	95% CI	OR	95% CI	OR	95% CI
Cancer	1.82	(1.76-1.88)	1.79	(1.71-1.88)	1.79	(1.72-1.86)
Circulatory	1.35	(1.32-1.39)	1.27	(1.22-1.32)	1.29	(1.25-1.33)
Endocrine	1.26	(1.23-1.30)	1.29	(1.24-1.34)	1.25	(1.21-1.29)
Respiratory	1.24	(1.20-1.27)	1.14	(1.09-1.20)	1.19	(1.15-1.23)
Musculoskeletal	0.84	(0.82-0.86)	0.82	(0.79-0.86)	0.82	(0.79-0.85)
Disability						
<3	1.00		1.00		1.00	
3-4	1.14	(1.09-1.19)	1.12	(1.05-1.20)	1.09	(1.03-1.15)
4-5	1.23	(1.18-1.28)	1.28	(1.20-1.37)	1.23	(1.17-1.29)
5-6	1.37	(1.32-1.43)	1.34	(1.25-1.42)	1.38	(1.31-1.44)
6-7	1.73	(1.65-1.80)	1.70	(1.59-1.81)	1.68	(1.59-1.76)
7-9	2.45	(2.35-2.56)	2.41	(2.25-2.57)	2.34	(2.22-2.47)
9+	4.03	(3.80-4.27)	4.05	(3.70-4.43)	3.93	(3.64-4.26)
Dyspnea						
never	1.00		1.00		1.00	
walking >20 ft	1.30	(1.25-1.34)	1.34	(1.28-1.41)	1.36	(1.30-1.41)
moderate exertion	1.57	(1.52-1.63)	1.64	(1.56-1.72)	1.68	(1.61-1.75)
at rest & with minimal exertion	2.14	(2.06-2.22)	2.20	(2.08-2.33)	2.25	(2.14-2.35)

REFERENCES

1. MedPAC. Healthcare spending and the Medicare program. Washington, D.C.: Medicare Payment Advisory Commission; 2006.
2. CMS. Overview of the Medicare and Medicaid programs. Health Care Financ Rev Stat Suppl. 2004;1-376, United States.
3. Intrator O, Zinn J, Mor V. Nursing home characteristics and potentially preventable hospitalizations of long-stay residents. J Am Geriatr Soc. Oct 2004;52:1730-1736, United States.
4. Shaughnessy PW, Hittle DF, Crisler KS, et al. Improving patient outcomes of home health care: findings from two demonstration trials of outcome-based quality improvement. J Am Geriatr Soc. Aug 2002;50:1354-1364, United States.
5. Konetzka RT, Spector W, Limcangco MR. Reducing Hospitalizations From Long-Term Care Settings. Med Care Res Rev. February 1 2008;65:40-66.
6. Simino Boyce P, Feldman PH. ReACH National Demonstration Collaborative: early results of implementation. Home Health Care Services Quarterly. 2007;26:105.
7. Dalby DM, Hirdes JP. The Relationship Between Agency Characteristics and Quality of Home Care. Home Health Care Services Quarterly. 2008;27:59.
8. Schlesinger M, Gray BH. How Nonprofits Matter In American Medicine, And What To Do About It. Health Aff. July 1 2006;25:W287-303.

9. Rosenau PV, Linder SH. A Comparison of the Performance of For-Profit and Nonprofit U.S. Psychiatric Inpatient Care Providers Since 1980. *Psychiatr Serv.* February 1 2003;54:183-187.
10. Devereaux PJ, Schunemann HJ, Ravindran N, et al. Comparison of Mortality Between Private For-Profit and Private Not-For-Profit Hemodialysis Centers: A Systematic Review and Meta-analysis. *JAMA.* November 20 2002;288:2449-2457.
11. Rosenau PV, Linder SH. The comparative performance of for-profit and nonprofit home health care services in the US. *Home Health Care Serv Q.* 2001;20:47-59, United States.
12. Zinn JS, Mor V. Organizational structure and the delivery of primary care to older Americans. *Health services research.* 1998;33:354.
13. Ellenbecker CH. Profit and non-profit home health care agency outcomes: a study of one state's experience. *Home Health Care Serv Q.* 1995;15:47-60, UNITED STATES.
14. Han B, McAuley WJ, Remsburg RE. Agency Ownership, Patient Payment Source, and Length of Service in Home Care, 1992 2000. *Gerontologist.* August 1 2007;47:438-446.
15. Scott WR. *Organizations: rational, natural, and open systems.* Upper Saddle River, N.J.: Prentice Hall; 2003.
16. Williams B. Comparison of services among different types of home health agencies. *Med Care.* Nov 1994;32:1134-52.

17. Estes CL. Running as fast as they can: organizational changes in home health care. *Home health care services quarterly*. 1992;13:35.
18. Shah A, Fennell M, Mor V. Hospital Diversification into Long-Term Care. *Health Care Manage Rev*. Summer 2001;26:86-100.
19. Clarke L, Estes CL. Sociological and Economic Theories of Markets and Nonprofits: Evidence from Home Health Organizations. *The American Journal of Sociology*. Jan. 1992;97:945-969.
20. Shortell SM, Morrison EM, Hughes SL, et al. Diversification of health care services: the effects of ownership, environment, and strategy. *Adv Health Econ Health Serv Res*. 1987;7:3-40, 111-4, UNITED STATES.
21. MedPAC. Report to the Congress : Medicare payment policy. Washington, DC: Medicare Payment Advisory Commission; 2004.
22. CMS. Overview of the Medicare and Medicaid programs. *Health Care Financ Rev Stat Suppl*. 2003;1-376, United States.
23. Brega AG, Jordan AK, Schlenker RE. Practice variations in home health care. *Home Health Care Serv Q*. 2003;22:41-64, United States.
24. Murkofsky RL, Phillips RS, McCarthy EP, et al. Length of stay in home care before and after the 1997 Balanced Budget Act. *JAMA*. Jun 4 2003;289:2841-2848, United States.
25. FitzGerald JD, Mangione CM, Boscardin J, et al. Impact of Changes in Medicare Home Health Care Reimbursement on Month-to-Month Home Health Utilization

- Between 1996 and 2001 for a National Sample of Patients Undergoing Orthopedic Procedures. *Med Care*. September 2006;44:870-878.
26. Haupt BJ. Characteristics of hospice care discharges and their length of service: United States, 2000. *Vital Health Stat 13*. Aug 2003;1-36, United States.
 27. Han B, Remsburg RE, Lubitz J, et al. Payment source and length of use among home health agency discharges. *Med Care*. Nov 2004;42:1081-90.
 28. Schwarz KA, Elman CS. Identification of factors predictive of hospital readmissions for patients with heart failure. *Heart & Lung: The Journal of Acute and Critical Care*. 2003/3;32:88-99.
 29. Li H, Morrow-Howell N, Proctor EK. Post-Acute Home Care and Hospital Readmission of Elderly Patients with Congestive Heart Failure. *Health Soc Work*. 11// 2004;29:275-285.
 30. Quan H, Sundararajan V, Halfon P, et al. Coding Algorithms for Defining Comorbidities in ICD-9-CM and ICD-10 Administrative Data.Article. *Med Care*. November 2005;43:1130-1139.
 31. Schneeweiss S, Wang PS, Avorn J, et al. Improved Comorbidity Adjustment for Predicting Mortality in Medicare Populations. *Health Serv Res*. 2003;38:1103-1120.
 32. Madigan EA, Curet OL. A data mining approach in home healthcare: outcomes and service use. *BMC Health Serv Res*. Feb 24 2006;6:18, England.
 33. Hittle DF, Nuccio EJ, Goodrich GK, et al. Appendix A: Documentation of Prediction Models Used for Risk Adjustment of Home Health Agency Outcome

- Reports. In: P. W. Shaughnessy and D. F. Hittle, eds. Overview of Risk Adjustment and Outcome Measures for Home Health Agency OBQI Reports: Highlights of Current Approaches and Outline of Planned Enhancements. Denver, Colorado: Center for Health Services Research, Division of Health Care Policy and Research, University of Colorado Health Sciences Center; 2003.
34. Holtzman J, Chen Q, Kane R. The effect of HMO status on the outcomes of home-care after hospitalization in a Medicare population. *Journal of the American Geriatrics Society*. 1998;46:629.
 35. Bao Y, Duan N, Fox SA. Is Some Provider Advice on Smoking Cessation Better Than No Advice? An Instrumental Variable Analysis of the 2001 National Health Interview Survey. *Health Serv Res*. 2006;41:2114-2135.
 36. OIG. Geographical Variation in Visits Provided by Home Health Care Agencies. Washington, D.C: United States. Dept. of Health and Human Services, Office of the Inspector General; 1995.
 37. Hosmer D, Lemeshow S. *Applied logistic regression*. New York: Wiley; 2000.
 38. D'Agostino R. Propensity score methods for bias reduction in the comparison of a treatment to a non-randomized control group. *Statistics in medicine*. 1998;17:2265, New York, NY.
 39. Brookhart MA, Schneeweiss S, Rothman KJ, et al. Variable Selection for Propensity Score Models. *Am J Epidemiol*. June 15 2006;163:1149-1156.

40. Weitzen S, Lapane K, Toledano A, et al. Principles for modeling propensity scores in medical research: a systematic literature review. *Pharmacoepidemiol Drug Saf.* 2004;13:841-853.
41. Estes CL, Swan JH. Privatization, System Membership, and Access to Home Health Care for the Elderly. *Milbank Q.* 1994;72:277-298.
42. Balinsky W. Proprietary and voluntary home care agency evolution: the emergence of a new entity. *Home health care services quarterly.* 1985;6:5.
43. Salvatore T. Organizational adaptation in the VNA: paradigm change in voluntary sector. *Home health care services quarterly.* 1985;6:19.
44. Billings J, Zeitel L, Lukomnik J, et al. Impact of socioeconomic status on hospital use in New York City. *Health Aff.* February 1 1993;12:162-173.
45. Fortinsky RH, Madigan EA, Sheehan TJ, et al. Risk Factors for Hospitalization Among Medicare Home Care Patients. *West J Nurs Res.* December 1 2006;28:902-917.
46. Proctor EK, Morrow-Howell N, Li H, et al. Adequacy of home care and hospital readmission for elderly congestive heart failure patients. *Health Soc Work.* 05// 2000;25:87.
47. MedPAC. Post-acute care. In: Anonymous A Data Book: Healthcare Spending and the Medicare Program. Washington, DC (601 New Jersey Avenue, NW, Suite 9000, Washington, DC 20001): Medicare Payment Advisory Commission; 2008.

48. MedPAC. Report to the Congress: Reforming the Delivery System. Washington, DC (601 New Jersey Avenue, NW, Suite 9000, Washington, DC 20001): Medicare Payment Advisory Commission; 2008.
49. OIG. Effect of the home health prospective payment system on the quality of home health care. Washington, D.C: United States. Dept. of Health and Human Services, Office of the Inspector General; 2005.
50. CMS. Home Health Compare Database Download. 3/24/2008, 2008.
51. DHHS. Medicare program; prospective payment system for home health agencies. Health Care Financing Administration (HCFA), HHS. Final rule. Fed Regist. Jul 3 2000;65:41128-214.
52. Medicare program electronic submission of cost reports: revision to effective date of cost reporting period. Interim final rule with comment period. Federal register. 2005;70:30640.
53. Proenca EJ, Rosko MD, Dismuke CE. Service Collaboration and Hospital Cost Performance: Direct and Moderating Effects.[Article]. Med Care. December 2005;43:1250-1258.
54. Gonzales TI. An empirical study of economies of scope in home healthcare. Health Serv Res. Aug 1997;32:313-24.
55. Anderson MA, Helms L. Home health care referrals following hospital discharge: communication in health services delivery. Hospital health services administration. 1993;38:537.

56. AHRQ. AHRQ Report on Home Health Quality Measures for CMS Public Reporting: Results of Technical Expert Panel Meeting and AHRQ Recommendations. 2002.
57. Teno JM, Gruneir A, Schwartz Z, et al. Association Between Advance Directives and Quality of End-of-Life Care: A National Study. *J Am Geriatr Soc.* 2007;55:189-194.
58. Rosati RJ. Development and testing of an analytic model to identify home healthcare patients at risk for a hospitalization within the first 60 days of care. *Home health care services quarterly.* 2007;26:21.
59. Murtaugh CM, Peng T, Aykan H, et al. Risk Adjustment and Public Reporting on Home Health Care. *Health Care Financ Rev.* Spring 2007;28:77-94.
60. Van Houtven CH, Norton EC. Informal care and health care use of older adults. ; 2004.
61. Scharpf T, Colabianchi N, Madigan E, et al. Functional status decline as a measure of adverse events in home health care: an observational study. *BMC Health Services Research.* 2006;6:162.
62. Basu J, Mobley LR. Do HMOs Reduce Preventable Hospitalizations for Medicare Beneficiaries? *Med Care Res Rev.* October 1 2007;64:544-567.
63. Abt Associates. HHA PPS Grouper Logic.
64. Kass DI. Economies of scope and home healthcare. *Health services research.* 1998;33:947.

65. Porell FW, Liu K, Brungo DP. Agency and Market Area Factors Affecting Home Health Agency Supply Changes. *Health Serv Res.* 2006;41:1847-1875.
66. Rothman K, Greenland S. *Modern epidemiology.* Philadelphia PA: Lippincott-Raven; 1998.
67. Smith L, Lapane K, Fennell M, et al. Home health agency profit orientation and risk for hospitalization: a propensity score analysis of population weighted data. *Home Health Care Serv Q.* 2008;27.
68. Liu K, Gage B, Harvell J, et al. Medicare's post-acute care benefit: Background, trends, and issues to be faced. 1999.
69. Fennell ML, Flood AB. Key challenges in studying organizational issues in the delivery of healthcare to older Americans. *Health Serv Res.* Jun 1998;33:424-433, UNITED STATES.
70. Hirth RA. Competition between for-Profit and Nonprofit Health Care Providers: Can it Help Achieve Social Goals? *Med Care Res Rev.* December 1 1997;54:414-438.
71. Keepnews D, Capitman JA, Rosati RJ. Measuring patient-level clinical outcomes of home health care. *J Nurs Scholarsh.* 2004;36:79-85.
72. Gage B, Morley M, Constantine R, et al. Examining Relationships in an Integrated Hospital System. 2008.
73. Kass DI. Economies of scale and scope in the provision of home health services. *Journal of health economics.* 1987;6:129.

74. Peng TR, Murtaugh CM, Meadow A, et al. Do Changes in Service Delivery Following the Introduction of Medicare Home Health PPS Differ by Agency Ownership? 2007.
75. Ashton CM, Del Junco DJ, Soucek J, et al. The association between the quality of inpatient care and early readmission: a meta-analysis of the evidence. *Medical care*. 1997;35:1044.
76. Fennell ML, Alexander JA. Perspectives on Organizational Change in the US Medical Care Sector. *Annual Review of Sociology*. 08/01 1993;19:89-112.
77. Gaynor M, Haas-Wilson D. Change, Consolidation, and Competition in Health Care Markets. *Journal of Economic Perspectives*. 1999;13:141-164.
78. Aldrich H, Pfeffer J. Environments of Organizations. *Annual Review of Sociology*. 1976;2:79-102.
79. Singh JV. Review: Density Dependence Theory-Current Issues, Future Promise. *The American Journal of Sociology*. Sep. 1993;99:464-473.
80. Federal Trade Commission, Department of Justice. Improving Health Care: A Dose of Competition. 2004.
81. Banaszak-Holl J, Zinn JS, Mor V. The impact of market and organizational characteristics on nursing care facility service innovation: a resource dependency perspective. *Health Serv Res*. Apr 1996;31:97-117, UNITED STATES.
82. Gaynor M. What Do We Know About Competition and Quality in Health Care Markets? National Bureau of Economic Research Working Paper Series. June 2006 2006;No. 12301.

83. Shortell SM, Hughes EF. The effects of regulation, competition, and ownership on mortality rates among hospital inpatients. *N Engl J Med*. April 28 1988;318:1100-1107.
84. Gaynor M, Haas-Wilson D. Change, consolidation, and competition in health care markets. *J Econ Perspect*. 1999;13:141-164.
85. Propper C, Burgess S, Green K. Does competition between hospitals improve the quality of care?: Hospital death rates and the NHS internal market. *Journal of Public Economics*. 2004;88:1247-1272.
86. Intrator O, Mor V. Effect of state Medicaid reimbursement rates on hospitalizations from nursing homes. *J Am Geriatr Soc*. Mar 2004;52:393-398, United States.
87. Zinn JS. Market Competition and the Quality of Nursing Home Care. *Journal of Health Politics Policy and Law*. September 1 1994;19:555-582.
88. Castle NG, Liu D, Engberg J. The association of Nursing Home Compare quality measures with market competition and occupancy rates. *J Healthc Qual*. Mar-Apr 2008;30:4-14, United States.
89. Scanlon DP, Swaminathan S, Lee W, et al. Does Competition Improve Health Care Quality? *Health Serv Res*. Sep 11 2008.
90. Cohen MA, Tumlinson AMMHS. Understanding the State Variation in Medicare Home Health Care: The Impact of Medicaid Program Characteristics, State Policy, and Provider Attributes. *Article. Med Care*. June 1997;35:618-633.
91. Swan JH, Benjamin AE. Medicare home health utilization as a function of nursing home market factors. *Health services research*. 1990;25:479.

92. Ruef M, Mendel P, Scott WR. An organizational field approach to resource environments in healthcare: comparing entries of hospitals and home health agencies in the San Francisco Bay region. *Health services research*. 1998;32:775.
93. Scott LD, Setter-Kline K, Britton AS. The effects of nursing interventions to enhance mental health and quality of life among individuals with heart failure. ; 2004.
94. Scott WR, Backman EV. Institutional Theory and the Medical Care Sector. In: Stephen S. Mick, ed. *Innovations in health care delivery : insights for organization theory*. San Francisco: Jossey-Bass Publishers; 1990:20-52.
95. Holmes JS. The effects of ownership and ownership change on nursing home industry costs. *Health Serv Res*. Aug 1996;31:327-346, UNITED STATES.
96. Grabowski DC, Castle NG. Nursing Homes with Persistent High and Low Quality. *Med Care Res Rev*. March 1 2004;61:89-115.
97. Dartmouth Medical School, Center for the Evaluative Clinical Sciences. *The Dartmouth Atlas of Health Care 1999/ the Center for the Evaluative Clinical Sciences*, Dartmouth Medical School. Chicago, Ill: Health Forum, Inc; 1999.
98. Baker LC. Measuring competition in health care markets. *Health services research*. 2001;36:223, [Oxford, England].
99. Scanlon DP, Swaminathan S, Chernew M, et al. Competition and Health Plan Performance: Evidence from Health Maintenance Organization Insurance Markets. *Med Care*. April 2005;43:338-346.

100. Scanlon DP, Swaminathan S, Chernew M, et al. Market and Plan Characteristics Related to HMO Quality and Improvement. *Med Care Res Rev.* December 1 2006;63:56S-89.
101. Kane RL, Finch M. Post-hospital home health care for Medicare patients. *Health Care Financ Rev.* 1994;16:131.
102. Wennberg JE, Fisher ES, Stukel TA, et al. Use of hospitals, physician visits, and hospice care during last six months of life among cohorts loyal to highly respected hospitals in the United States. *BMJ.* Mar 13 2004;328:607, England.
103. Fisher ES, Wennberg JE, Stukel TA, et al. The implications of regional variations in Medicare spending. Part 1: the content, quality, and accessibility of care. *Ann Intern Med.* Feb 18 2003;138:273-287, United States.
104. Arbaje AI, Wolff JL, Yu Q, et al. Postdischarge environmental and socioeconomic factors and the likelihood of early hospital readmission among community-dwelling Medicare beneficiaries. *Gerontologist.* Aug 2008;48:495-504, United States.