ASSESSING THE QUALITY OF PRIMARY HEALTH CARE IN A REMOTE COUNTY OF TAIWAN

by
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ABSTRACT

The purpose of this study was to evaluate the association between the quality of primary care and patient-reported health status, patient disease-specific clinical outcomes, and patients' satisfaction with their care experience in a remote county of Taiwan. The two aims of our evaluation of health care quality were as follows: 1. To validate the Primary Care Assessment Tool (PCAT) in Taiwan, and 2. To examine the associations between domains of primary care quality and patient outcomes.

This study was a population-based cross-sectional survey performed on offshore islands northwest of Taiwan with 12,700 inhabitants. The reliability of the PCAT-C was assessed by measuring internal consistency reliability. Factor analysis and construct validity were used in confirming the hypothesis supporting the composite score.

This study used the Primary Care Assessment Tool - Chinese Edition (PCAT-C), which includes four core domains (first contact, longitudinality, comprehensiveness, and coordination) and three related domains (family centeredness, community orientation, and cultural competence). A visit-based questionnaire was used to gather information.

Our validation analysis (Study Aim 1) shows that all the seven domains of primary care captured in PCAT-C are retained and the PCAT is a valid, reliable and responsible tool with

psychometric properties in the multidimensional quantification of primary health care, similar to previous PCAT-related validation effort (H1 & H2).

Study Aim 2 examines the associations between domains of primary care quality and patient outcomes. The analysis shows that those with chronic illness performed better than those without in all the primary care domains (H3). The analysis also indicates that primary care overcomes the gaps between different education and income level, but good primary care experience hinges on it adequate supply (H4). The analysis further demonstrates significant association between PCAT quality and satisfaction (H5). Finally, on the relationship between primary care quality and disease-specific clinical outcomes (H6), the analysis yields mixed findings.

The Primary Care Assessment Tool provides an excellent method for assessing and identifying ways in which primary care systems can be improved; as such, it is important to ensure that the instrument stays updated and malleable to change as the field of health care evolves.

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CHAPTER 1. INTRODUCTION

1.1 Problem Statement

Primary care plays an important role in the prevention of illness and death. Research has shown that the distribution of primary care is more equitable than that of specialty care, underlining the importance of determining whether existing primary care services meet the needs of the population (Starfield, 2002). Health care providers have recognized that consumer satisfaction can be used as a measure of quality; however, this generally reflects only the needs of specific groups of patients (Williams, 1994; Zastowny, 1983). Therefore, in this study we used the Adult Primary Care Assessment Tool - Chinese Edition (PCAT-C) to evaluate the quality of primary care delivered in a remote county in Taiwan to analyze the probability of improvement. PCAT-C is an objective and general instrument of which the efficacy has previously been validated, but only in Mainland China and not yet in Taiwan (Shi, 2001). Validity represents the quality of the study and comprises two parts: measurement reliability and measurement validity. The validity of the PCAT-C in Taiwan will be assessed prior to use on the general and chronically ill patient population. Although much research has been conducted around the world regarding the relationship between primary care quality and patient outcomes, relatively few studies have been conducted in Taiwan where the role of primary care is still not fully recognized.

1.2 Research Objectives

The aims of evaluating the health care quality in a county in Taiwan were as follows:

Study Aim 1. To validate the Primary Care Assessment Tool (PCAT) in Taiwan.

H1: The PCAT-C is valid for the rural Taiwanese patient population of offshore islands.

H2: The PCAT-C is valid for the rural Taiwanese chronically ill patient population of offshore islands.

Study Aim 2. To examine the associations between domains of primary care quality and patient outcomes.

H3: Better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better patient-reported health status.

H4: Better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with selected patient-level socioeconomic characteristics such as education, income, and living places.

H5: Better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better patient satisfaction with the experience of care.

H6: Better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better patient disease-specific clinical outcomes.

CHAPTER 2. LITERATURE REVIEW

The online medical library, PubMed, was used to search relevant literature using keywords in a specific publishing timeframe. All papers were limited publications in the English language.

2.1 Definition of Primary Care

In her landmark book *Primary care: balancing health needs, services and technology*, Dr. Starfield gave a comprehensive definition of primary care, as the provision of integrated, accessible healthcare services by clinicians who are accountable for addressing a large majority of personal healthcare needs, developing a sustained partnership with patients, and practicing in the context of family and community (Starfield, 1998). She summarized the following characteristics of primary care (pp. 19–34).

i. Integrated care is intended to encompass the provision of comprehensive, coordinated, and continuous services that provide a seamless process of care. Integration combines information about events occurring in disparate settings and levels of care as well as over time, preferably throughout the life span.

ii. Comprehensive care addresses any health problem at any given stage of a patient's life cycle.

iii. Coordinated care ensures the provision of a combination of health services and information to meet a patient's needs. It also refers to the connection between, or the rational ordering of, those services, including the resources of the community.

iv. Continuous care is a characteristic that refers to care over time by a single individual or team of healthcare professionals (“clinician continuity”) as well as to effective and

timely maintenance and communication of health information (events, risks, advice, and patient preferences) (“record continuity”).

v. Accessible care refers to the ease with which a patient can initiate an interaction for any health problem with a clinician (e.g., by phone or at a treatment location) and includes efforts to eliminate barriers such as those posed by geography, administrative hurdles, financing, culture, and language.

vi. Healthcare services refer to an array of services that are performed by healthcare professionals or under their direction, for the purpose of promoting, maintaining, or restoring health. The term refers to all settings of care (such as hospitals, nursing homes, physicians' offices, intermediate care facilities, schools, and homes).

vii. A clinician is an individual who uses a recognized scientific knowledge base and has the authority to direct the delivery of personal health services to patients.

viii. Accountability is applied to primary care clinicians and the systems in which they operate. These clinicians and systems are responsible to their patients and communities for addressing a large majority of personal health needs through a sustained partnership with a patient in the context of a family and community and for (1) quality of care, (2) patient satisfaction, (3) efficient use of resources, and (4) ethical behavior.

ix. A majority of personal healthcare needs refer to the essential characteristic of primary care clinicians: that they receive all problems that patients bring—unrestricted by problem or organ system—and have the appropriate training to manage a large majority of those problems, involving other practitioners for further evaluation or treatment when appropriate. Personal healthcare needs include physical, mental, emotional, and social concerns that involve the functioning of an individual.

x. Sustained partnership refers to the relationship established between the patient and clinician with the mutual expectation of continuation over time. It is predicated on the development of mutual trust, respect, and responsibility.

xi. A patient is an individual who interacts with a clinician either because of real or perceived illness or for health promotion and disease prevention.

xii. Context of family and community refers to an understanding of the patient's living conditions, family dynamics, and cultural background. Community refers to the population served, whether they are patients or not. It can refer to a geopolitical

boundary (a city, county, or state), members of a health plan, or neighbors who share values, experiences, language, religion, culture, or ethnic heritage.

2.2 Definition of Primary Care Quality

Primary care is a point of entry to the health care system for many people who need it. Coordination of horizontal and longitudinal medical resources is one of its many important functions. Health care equality is an important issue for primary care, and a universal health insurance system has recently been heavily discussed in the US and around the world.

Health care reform in the Netherlands and in the U.S. identified five important aspects related to primary care quality: (1) health insurance for all individuals, particularly the vulnerable, i.e. a private insurance model compatible with primary care and a primary-care-led health care system; (2) continuity of care and community orientation with a focus on local needs; (3) collaboration among providers of primary care, hospital care, and public health; (4) research that is beneficial to primary care professionals; and (5) health informatics using the International Classification of Primary Care (Weel, 2012). Recommendations have been made for China to incorporate a primary care model into its national health policy. This includes supporting the primary care workforce, addressing the medical financing structure, introducing evidence-based medicine, and learning from the experiences of health reform in other countries (Hung, 2012).

In the following section, domains of primary care quality were covered. Technical and interpersonal elements can be used to evaluate the performance of practitioners (Donabedian, 1998).

2.3 Diversions of Primary Care Quality

In a comparison of primary care with secondary and tertiary care, Starfield (1998) identified four key features of primary care that are important for assessment: being the gatekeeper of access, longitudinality, comprehensiveness, and coordination. Valuation of the consequences of care and monetary considerations are also important. Information concerning the quality of care can be classified into three categories: structure, process, and outcome. Medical records are key sources of information concerning the process of care and its immediate outcome. A number of predictors have been identified for use in the evaluation of care quality (Cambell, 2011). There are four measurable outcomes: the quality of clinical care for chronic disease management (i.e. angina, asthma, and Type 2 diabetes); the quality of preventive care (i.e. immunization rates and pap smears); patient evaluation of access and interpersonal care (i.e. using a general practice assessment survey); and team climates and effectiveness.

2.4 Quality Assessment of Primary Care

The Primary Care Assessment Tool (PCAT) is a collection of questionnaires, developed by Johns Hopkins Primary Care Policy Center under the leadership of the late Dr. Barbara Starfield and Dr. Leiyu Shi, that assess whether a healthcare provider or system is achieving the four core functions of primary care (first contact, longitudinality, comprehensiveness, and coordination) and three supplementary aspects of primary care (family centeredness, community orientation, and cultural competence). The first PCAT-adult questionnaire was developed and validated in the USA (Shi et al., 2001a, Shi et al., 2001b) but its validity and reliability have been demonstrated in other countries, such as in Brazil (Harzheim et al., 2006) and Spain (Rocha et al., 2012). Several forms of the PCAT exist, varying in length and target population. For example, while the Primary Care Assessment Tool-Adult Edition's (PCAT-AE) original form includes 74 items assessing adult patient experiences with primary care (Shi et al., 2001a, Shi et al., 2001b) a short 10-item version, the PCAT10-AE has also been used and integrated into a national population health survey (Rocha et al., 2012). A PCAT assessing the primary care experiences of children has been developed as well (Harzheim et al., 2006; Berra et al., 2011). In addition to these questionnaires targeting patients, versions of the PCAT have been developed that also survey providers and administrators of facilities, providing another perspective on the provision of primary care (Haggerty et al., 2008).

In this study, the psychometric properties of primary care quality in Taiwan were examined. The PCAT was developed to assist in evaluation. It is based on the theoretical model of primary care attributes developed by Dr. Barbara Starfield (Starfield, 2005). This study used the adapted Primary Care Assessment Tool - Chinese Version (PCAT-C) (Yang, 2013); it includes a questionnaire of 43 items. Two questions deal with regular source of care. Five items measure utilization patterns and the frequency of visits to a primary care provider (PCP). Thirty-six items are used to assess patient perceptions on the quality of primary care. These are divided into six scales with six core domains: first contact, longitudinal/ongoing care, coordination, comprehensiveness (services provided), family centeredness, and community orientation. An additional 23 items are used to assess patient-level covariates.

In the UK, the quality of primary care is evaluated using the General Practice Assessment Survey (GPAS) (Ramsay, 2000). The GPAS identifies nine key areas of primary care (access, technical care, communication, interpersonal care, trust, knowledge of patient, nursing care, receptionists, and continuity of care), and includes seven multiple-item scales and two single-item scales. It also includes four items related to patient perceptions on the role of the primary care physician in referrals and coordination of care, goodwill in the provision of suggestions, and overall satisfaction of patients. Unfortunately, the GPAS is available only in English and lacks a measure for assessing patient dissatisfaction.

Primary care physicians (PCP) are crucial to the coordination of care. A number of studies have compared differences between patients who identify a specialist as their PCP (SP-PCP) and those who frequent a general practitioner (GP-PCP). Compared to SP-PCP patients, patients with GP-PCPs tend to report higher scores in several primary care domains (ongoing care, coordination of service, comprehensiveness, and community orientation) and in total primary care performance. Users of CHCs are more likely than users of health maintenance organizations (HMOs) to rate their primary care provider as good, except in the area of obtaining access to care (Shi, 2003). In a study of patients' global ratings of their health care, better communication was associated with higher global ratings of care, including patient and clinical factors (Chang, 2006)

Patients who attend CHCs are also more likely to have better primary care experiences than patients attending hospital facilities. However, most patients report low scores for community orientation, family-centeredness and coordination. There is a need for more coordination between community health centers and hospitals, more financial reimbursement, more formal government contracts, better qualifications for health care providers at the community level, and more training in teaching hospitals (McCollum, 2014). Patients with a contracted GP tend to experience a higher quality of primary care, so promoting the implementation of family practice contract services is useful. First contact and coordination

services should be improved before family practice contract services are implemented (Li, 2018). Access is the primary indicator of health care quality. Timely access to structures and care processes, as well as the receipt of effective care, directly influence the quality of primary health care (PHC). Research has shown that scheduling models have a positive effect on user perception of quality in primary health care centers (Vidal, 2018).

We identified six tools that are commonly used to assess PHC: the WHO primary Care Assessment Tool (PCET), the ADHD Questionnaire for Primary Care Providers (AQPCP), the General Practice Assessment Questionnaire (GPAQ), PACOTAPS (a primary health care software), the Primary Care Assessment Tool (the PCAT), and the European Task Force on Patient Evaluation of General Practice Care (EUROPEP) (Fracolli, 2014). The PCAT is based on a theoretical framework of primary care domains and characteristics to evaluate primary care and the integration of users with sources of health care. The use of research tools in the assessment of PHC could lead to the creation of new proposals by which to improve family health care, so the PCAT was determined as a suitable tool for this study. Besides providing an overall assessment of PHC, the PCAT has also been used as an instrument adapted for TB care, emphasizing the dimensions of PHC (Sá,2015).

Another PHC assessment tool known as the service availability and readiness assessment (SARA) is comprised of a set of indicators for defining whether a health facility

meets the required conditions for providing basic or specific services. It is a more objective tool and not as psychosocial as the PCAT (Jigjidsuren, 2019). In order to improve quality, the electronic assessment tool presented a feasible option for routine quality measures of primary health care. A systematic assessment of primary care quality was carried out in outpatient departments of all health facilities within a given council using the Electronic Tool to Improve Quality of Healthcare (e-TIQH). Six quality dimensions were defined, including physical environment and equipment, job expectations, professional knowledge, skills and ethics, management and administration, staff motivation, and client satisfaction (Renggli, 2019).

When the PCAT test was performed on users and health care providers, the results could be different. With regard to the comprehensive services available, comprehensive services provided, and community orientation, users scored significantly lower than practitioners and managers (Bresick, 2016).

2.5 Validity and Reliability of the PCAT-C

The adult edition of the PCAT has been validated by researchers. All five assumptions of item-convergent validity, item-discriminant validity, equal item variance, equal item-scale correlation, and score reliability were met, indicating that these items may be used to

represent the primary care scales (Shi, 2001). As with the Likert's method of summated rating scales, the scoring of these items may be summed without standardization or weighting.

In this study, we use the PCAT-C to evaluate the quality of primary care delivered on offshore islands of Taiwan. The measurement reliability and measurement validity of the PCAT-C were evaluated prior to use. Using Cronbach's alpha, internal consistency reliability was reported for perceived group-level behavior (Chan, 2011). The criterion-related evidence of validity includes concurrent and predictive evidence. The construct-related evidence of validity includes convergent, discriminant, and factorial evidence (Morgan, 2001).

Although methods to assess reliability include test-retest, parallel forms, internal consistency, and interrater reliability, only internal consistency was performed in this study (Gliner, 2001). In a study of reliability and validity of 4-metre gait speed in COPD, a usual gait speed over 4 m (4MGS) in COPD had excellent test-retest reliability. Significant associations with exercise capacity, health status and dyspnea demonstrated evidence of concurrent validity (Kon, 2013).

Similarly, even if there is evidence of content, criterion, and construct validity, only factor analysis and construct validity were discussed in this study. There are three types of construct-related evidence for validity: convergent, discriminant, and factorial evidence. Unlike PedsQL^{TM} 3.0 SF 22, there is no specific disease component of PCAT-C that can be

used for hypertension, diabetes, or chronic obstructive pulmonary disease (COPD) (Chan, 2005).

There are three methods to assess the PCAT-C: imputing missing data, identifying primary care domains by principal component analysis, and testing internal consistency and correlations between items and scales as well as between scales.

To check content validity, missing data and the response category 'not sure/don't remember' were checked and imputed using multiple regression. Cronbach's alpha values and average inter-item correlations were checked by coding and imputation. To check the principal component analysis and item reliability analysis, the eigenvalues were examined. To check the internal consistency reliability for group level comparison, Cronbach's alpha (=0.7) was examined. Item-convergent and item discriminate validity were checked by item-scale correlations and item, other scale correlations. Besides statistical analysis, we also considered the conceptual significance of the items and whether or not they are supported as appropriate elements in their scales.

The inter-scale correlations were checked as further evidence for the uniqueness of the concepts of the scales. Patient satisfaction was tested by the concurrent validity of the scales with three components: first contact, outreach and stableness of the PCP. The score distribution for the total mean score and scale mean scores were estimated to check the full

range of possible scores for all scales.

Finally, determining the right sample size of a study is very important. If a study is reliable and valid, the right sample size is time-sensitive and the cost of the study is usually high. In fact, most researchers should set up their study plans based on resource constraints. They should consider both resource expenditure and result confidence. It is hard work to determine the necessary sample size under the reliability of acceptable risk. As a rule, there are two methods for determining sample size. One is the estimation approach, which is based on confidence intervals. The other is the risk control approach, which is based on controlling Type I and Type II errors (Guo, 2013).

2.6 Health Status and Primary Care Quality

Assessing the relationship between primary care quality and self-rated health status led to the development of the Korean Primary Care Assessment Tool (K-PCAT), which revealed that the quality of primary care is positively associated with positive self-rated health status. Researchers utilized five models to assess the relationships between primary care scores and socio-demographic factors with self-rated health status (Sung, 2013). Primary care quality, particularly the family centeredness domain, was found to have a significant positive association with self-rated health status (Wang, 2015).

In studies on mental health, significant cross-lagged effects have been observed between baseline satisfaction with care and subsequent mental health; however, the reverse was not shown to be true. Health status at baseline was assessed using the 36-item Short-Form Health Survey (SF-36), which was developed for use in the Medical Outcome Study (MOS), and patient satisfaction was assessed using the Patient Satisfaction Questionnaire III, comprising 50 items covering seven aspects of satisfaction (MOS; PSQ-III; Marshall et al., 1993). If users with and without disabilities evaluated the health care received similarly, that indicated shortages on the recognition of specific demands. Structural and work process changes should be made, especially to ensure accessibility, comprehensiveness, and family and community orientation to increase the quality of PHC (Almeida, 2017). In many areas, first contact access, relational continuity and comprehensiveness of services available scored below the minimum level, and patients' experiences with primary care were associated with sex, geographical location, self-rated health status, duration of contact with the facility, and facility affiliation (Dullie, 2018).

2.7 Satisfaction with Primary Care Quality

Several factors affect the health care feedback provided by patients. Patients who frequent the same health care provider for most of their visits tend to report a superior medical care

experience, particularly with regard to accessibility and utilization, ongoing care, the coordination of referrals, and the family-centeredness and cultural competence of the attending physician. Patients with a higher household income and better subjective health status also tend to report care of higher quality (Tsai, 2010).

Individuals with more urgent health needs, such as the elderly, minority ethnic groups, low-income patients, and those with chronic conditions, tend to have higher mean continuity of care scores (Jatrana, 2011). Previous researchers have shown that continuity of care tends to be associated with good health outcomes, high quality care, high patient satisfaction, and lower health care costs (Christakis, 2002). Continuity of care has also been shown to affect the quality of medical care resulting from greater familiarity with the patient, which can manifest in the use of resources and time-saving as well as diagnostic and therapeutic measures (Hjortdahl, 1991). Among men aged 55 years and older, continuity of primary care is associated with stronger patient satisfaction, shorter hospitalizations, and fewer emergency room admissions (Wasson, 1984).

Indicators of community orientation (CO) tend to be higher in community health centers (CHCs) than in other settings, such as family practices, health service organizations, and family health networks (Muldoon, 2010).

Primary care and hospital care should complement each other in a health care system.

Improvements in medical skills and technology as well as patient-centered measurement techniques have occurred in recent years. A new category of quality indicators, including those of patient satisfaction, quality of life, or those for public health and epidemiological issues, has also been developed to facilitate the fitting of real patient perceptions (Hung, 2014). In some urban areas, different levels of health care institutions had different PCAT scores. Township health center/rural health station users expressed better primary care only in the ongoing care domain. This highlights the need for improvement in primary care provided by primary care institutions. (Zeng, 2015)

with regard to traditional Chinese medicine (TCM), ratings were lower in areas of "coordination of patient information," "continuity of care," and "range of service provided." To improve patient experience, strengthening care coordination, continuity and comprehensiveness in TCM primary care services should be considered. Sharing of electronic records and establishing a referral system are probable solutions for linkage of TCM and conventional health care services (Chung, 2015). If primary care policies can improve long-term provider-patient relationships, coordinated service with hospitals and capitation payment for the GP team, they may also improve care quality (Yin, 2016).

From the perspective of patients with multiple diseases receiving care in a primary care setting, practices in care and counselling could be improved to assist patients in the

setting of specific goals, coordinating care, and arranging follow-up contacts. Health care providers must be aware that the assessments provided by patients are associated with physician-related factors as well as patient-related factors (Petersen, 2014). The risk factors of metabolic syndrome (MetS) are used as an objective reference with which to evaluate the multi-morbid condition of patients (Alberti, 2005).

The concept of patient satisfaction (derived from consumer satisfaction) is an evaluative reaction to the interaction of a product and the expectations of the individual (Hunt, 1977). The Linder-Pelz model (Linder-Pelz, 1982) is based on psychological theories in which satisfaction is related to health status, such that patients enjoying good care and medical processes tend to be more satisfied. We also planned to evaluate the structure, processes, and outcomes of primary care services and how they pertain to the issue of satisfaction. A number of previous researchers have discussed the relationship between patient satisfaction and clinical outcomes of disease (Pascoe, 1983). Using the General Practice Assessment Survey Questionnaire (GPAS), they found that processes that can act to increase patient satisfaction may contribute towards improved clinical outcomes (M. H. Alazri and R. D. Neal, 2003).

Despite the fact that satisfaction has been linked to overall health, emotional status, and social activity, no link to cognitive function has been indicated and the entire issue remains

highly subjective. The average satisfaction of patients also shows a significant degree of variance according to physicians (Hall, 1990). Researchers have attempted to follow the causal paths between patient satisfaction and health status; however, no link has yet been identified (Hall, 1993).

Usual source of care (USC) refers to the provider or place that a patient consults when sick or in need of medical advice. Having a usual source of care was independently and significantly associated with patients' satisfaction with care. Patients with a USC reported higher quality medical care experiences compared with those without a USC, so any effort to improve quality of care should include policies promoting a USC (Du,2015).

Even though most people have the perception that the health care quality in hospital settings is better than at CHCs, the total PCAT scores and scores for first contact-access, ongoing care, comprehensiveness-services available, and community orientation and satisfaction of CHCs are higher than for secondary and/or tertiary hospitals (Hu, 2016). Although having different cultural and organizational backgrounds, many locations demonstrated that their own health services are PHC-oriented, and their health care services, care continuity and facilitated access meet the needs of the population (D'Avila, 2017). Because men have been neglected by the absence of specific preventive actions which tend to target children, women and the elderly, the features of primary care are unsatisfactory to the

need of expanding access to services offered and qualifying care for male users (Silva, 2018).

2.8 Clinical Outcomes and Primary Care Quality

Many researchers have evaluated the outcomes following transitional care interventions for older patients moving from a hospital to their home. Transitional care interventions have been shown to reduce cases involving the re-hospitalization of patients. The outcome used to measure re-hospitalization and length of stay focuses on effectiveness, efficiency, safety or risk, and patient satisfaction (Allen, 2014). In order to get a comprehensive assessment of performance in primary care practice, multiple data collection methods are required. Careful consideration of the biases should be considered to choose the best method for any one special study or quality improvement initiative (Green, 2012).

In a study of academic family health teams (aFHTs) that provided high quality primary care, it was found that several domains could be improved, especially first contact-accessibility. A large number of physicians were not associated with high performance on PC domains. It is interesting that distributed practices across multiple sites were negatively associated with high performance for some domains. Even with electronic medical records, performance on coordination of information systems had room for improvement (Carroll, 2016).

CHAPTER 3. MATERIALS AND METHODS

3.1 Conceptual Framework

Most health care systems strive for quality, equity, and efficiency. The performance of these objectives can be measured. In his well-known model to help define and measure quality s, Donabedian (1985) suggested three domains in which quality could be measured: structure, process, and outcomes. The three domains are closely linked and hierarchical. Structure is the foundation of quality. Good processes require a good structure; deficiencies in structure have a negative effect on the processes of health care provision. Structure and process together influence outcomes. Structure primarily influences process and has only a secondary direct influence on quality outcome. When desired outcomes are not achieved, one must examine the processes and structures to identify and correct deficiencies.

In this study, performance measurements are based on Donabedian's classic 1973 model of "structure," "process," and "outcome" for assessment of care quality. An effective measurement index should focus on patients, families, and communities (Fig.1, Starfield, 1973).

According to the Donabedian triangle, a framework including evidence of medical and contextual policy is needed to evaluate the quality of primary care. Medical evidence, the context of medical encounters, and cost utility and equity are discussed (Driel, 2005). The

process and outcome components of quality improvement have been studied in literature, but structure has been ignored. Several key elements of organization are discussed, including executive management, senior leadership, board responsibilities, culture, organizational design, incentive structures, and information management and technology (Glickman, 2007).

Multi-morbidity is prevalent in primary care and increases the challenge of assessment and management. Process measures are disease-specific except for functional outcomes, health care utilization and patient-rated measures. Although a reliance on process and outcome for single conditions in the assessment of quality of care was measured, a broader, more comprehensive measurement of structure, process and outcome is needed to evaluate the care of multimorbid patients (Pillay, 2014). In assessing the quality of care of post-acute rehabilitation (PAC-rehab), an evidence-based conceptual framework was presented. The Donabedian model could be used to discuss the structure of the PAC-rehab quality framework (Jesus, 2015).

The are two principal dimensions connecting to the quality of care for individual patients: access and effectiveness, which include clinical care as well as inter-personal care. The framework is based on the quality of care with regard to individual patients; however, health care for individuals must be placed in the context of health care for populations, and additional components of equity, efficiency, and cost must not be overlooked (Cambell,2000).

Another study listed four indicators for quality of care: stewardship, organizational structures, process of care, and intermediated outcomes (Sibthorpe, 2007).

In 1978, the Institute of Medicine (IOM) listed accessibility, comprehensiveness, coordination, continuity, and accountability as the essential aspects of PHC. According to the Alma-Ata Declaration signed in 1978, PHC should be the central function of national health systems, dealing with disease prevention, health promotion, curing disease, and facilitating rehabilitation. It was also noted that a national health care scheme is central to the overall social and economic development of a community. The World Health Organization has measures for each of the core domains of primary care: longitudinality, comprehensiveness, coordination, family-centeredness, and community orientation (Alma-Ata Declaration, 1978; Shi, 2001). In this study, we adopt the Primary Care Assessment Tools (PCAT) for the measurement of health care quality. The PCAT was used in a conceptual framework of strengthened HIV primary care services in the US that could strengthen the capacity of local partners to deliver excellent health programs in resource-limited settings (Reyes, 2014).

To enable a comprehensive assessment of the provision of primary care, we will focus on three aspects of the problem: patient-reported health status, patients' satisfaction with their care experience, and patient disease-specific clinical outcomes. Each of these aspects was examined from the perspective of domains of primary care quality (PCAT-C).

Figure 2 illustrates the conceptual framework used in assessing the association of the quality of primary care and patient-reported health status, patients' satisfaction with their care experience, and patient disease-specific clinical outcomes. The six research hypotheses under two study aims are also plotted in the figure. The framework may be construed as focusing on the 'process' and 'outcome' components of the Donabedian's 'structure-process-outcome' paradigm.

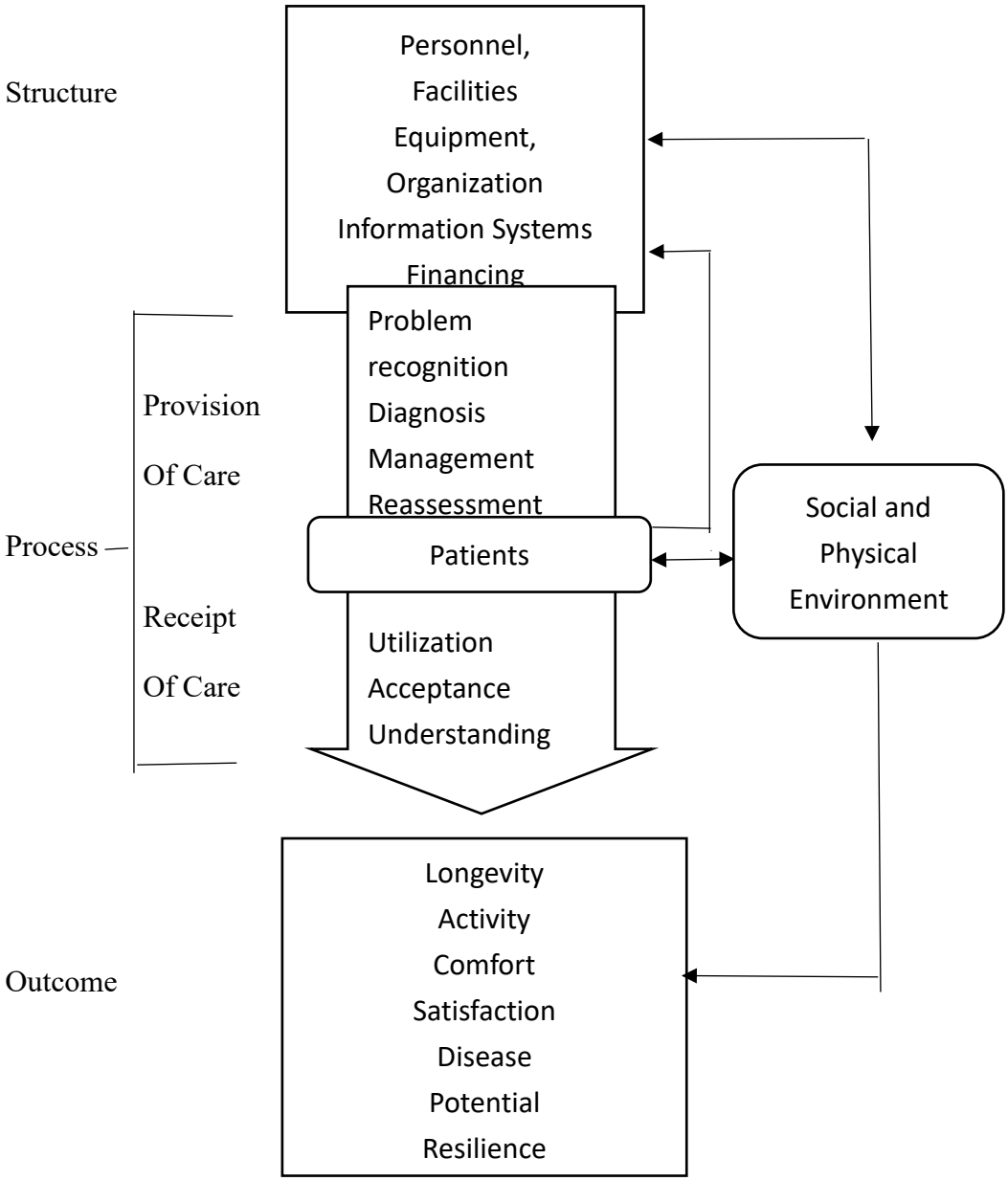

Figure 1. Dynamics of health outcomes (Starfield, 1973)

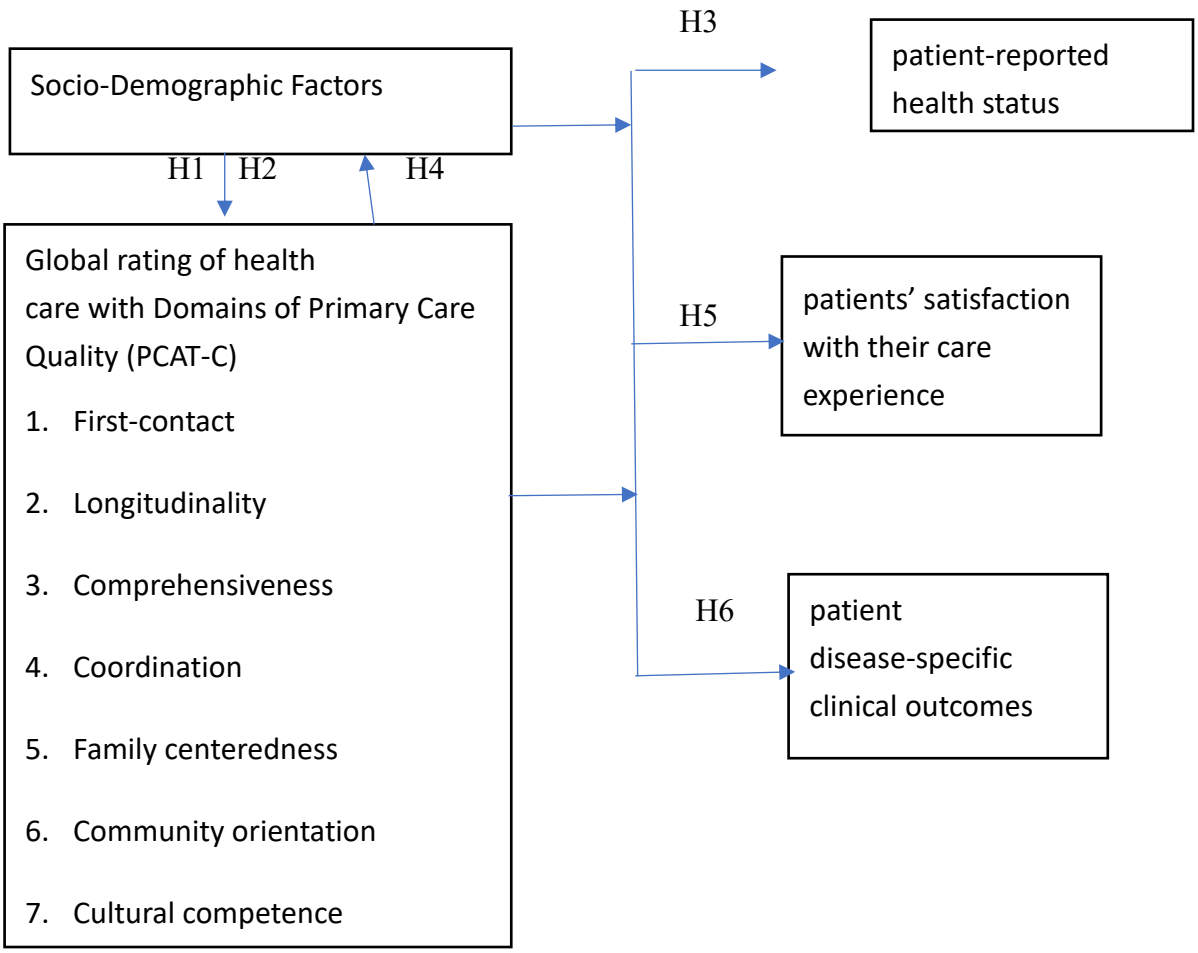

Figure 2 Conceptual framework used in assessing the quality of primary care, patient-reported health status, patients' satisfaction with their care experience, and patient disease-specific clinical outcomes.

3.2 Research Questions

This study will focus on two crucial questions (study aims):

a. Is the PCAT-C valid for the rural Taiwanese patient population and the patient population of Taiwan's offshore islands?

b. Are there significant associations between primary care quality and patient-reported health status, patients' satisfaction with their care experience, and patient disease-specific clinical outcomes?

To investigate the effect of health care facilities on the above constructs, we will need to identify the factors that affect patients' selection of venue and the ultimate effect this choice has on their level of satisfaction. Primary care has been connected to better health status, lower overall mortality, lower death rates associated with heart disease and cancer, longer life expectancy, lower neonatal mortality, and a lower likelihood of low birth weight (Shi,1994). We will investigate the link between the scores of PCAT-C and patient-reported health status, patients' satisfaction with their care experience, and patient disease-specific clinical outcomes among patients.

Primary care can be improved to reach specific goals, coordinate care, and arrange follow-up contacts with multi-morbid patients, and a patient's assessment (Petersen, 2014). Patients with chronic diseases, such as COPD, asthma, DM, or CHF, could also benefit from coordination of care, thereby reducing the frequency of hospital admissions and readmissions (in CHF and DM), enforcing compliance with treatment guidelines (DM, COPD, and asthma), and improving quality of life (DM). There are almost no reviews that found evidence of a decrease in costs (Martinez-Gonzalez, 2014). In low-and middle-income countries, improving the quality of care has been shown to improve outcomes such as health status, life expectancy,

and regional shortfalls. Health policy aimed at evaluating the quality of care has the potential to improve treatment for chronic disease (Peabody, 2014). This study will be collecting self-reported statements from patients in conjunction with bio-physiological (i.e., objective) data to clarify the effects of health status on the experiences of patients with regard to primary health care.

3.3 Study Design and Methods

The National Health Insurance (NHI) of Taiwan was implemented in 1995 and more than 96% of the population is currently enrolled in the program. Many remote areas are served by public service doctors at local hospitals of CHCs, including family physicians, internal medicine physicians, pediatricians, and other specialists.

This study was a population-based cross-sectional survey performed on the offshore islands northwest of Taiwan (20,000 inhabitants). We began by investigating socio-demographic factors through the use of visit-based sampling. Each island has a community health center with at least two doctors and one island has a hospital with 15 doctors.

3.3.1 Study population

Lienjiang County contains four islands located northwest of Taiwan. There is one local hospital and five community health centers (CHCs), each with two to four family physicians who are internal medicine physicians, pediatricians, or other specialists. All of the physicians

practice general medicine on site at least three days per week and all of them have worked at the CHC or local hospital for at least six months. We recruited residents for interview while they were receiving their free annual health examination offered at the CHCs and hospitals. Inclusion criteria included local residency, ≥ 30 years old, users of primary care as a source of health care, and experience visiting a specialist at least once in their life. Data collection spanned 1-5 days at each CHC or hospital. Questionnaires were administered directly by trained research technicians. Questionnaires with < 50% of all the items filled out were excluded.

To achieve reliability > 0.7 at the practice site level, the required sample size had to be clarified (Sequist, 2011). Previous records indicate that the rate of participation in the annual health examination was approximately 30% of the adult population in Lienjiang County; therefore, reliability needed to be ≥ 0.7 with the ability to reveal at the clinic level.

3.3.2 Primary care assessment tool: PCAT-C

The Primary Care Assessment Tool - Chinese Version (PCAT-C) was modified from the Primary Care Assessment Tool - Adult Edition (PCAT-AE), the efficacy of which has been validated for the study of primary care quality. Researchers have abbreviated this tool in a number of forms: a 10-item questionnaire (PCAT10-AE), 15-item questionnaire (PCAT

customer client version) and 24-item questionnaire for children under 15 years of age (Rocha, 2011; Pasarin, 2007; Berra, 2011). Metric analysis supports the integrity and general adequacy of this tool; however, we used the expanded version in this study. Since it was altered from the PCAT-AE, the validity of the PCAT-C was evaluated using exploratory factor analysis (EFA) prior to use (Fayers, 1997).

3.3.3 Data collection

The plan for this study was to recruit adults aged 30 years old or older. Participants were assigned to separate groups based on six domains of the Primary Care Assessment Tool - Chinese Version (PCAT-C) (see Appendix 2) (Yang, 2013). Patients were handed the questionnaires directly while they attended their integrated health screening examination. Overall clinical outcomes were determined from patient-reported health status and laboratory data obtained during health examinations from 2016 to 2017.

All information (PCAT-C questionnaire and sociodemographic questions) was collected by research technicians on-site. We then analyzed the quality measures of the PCAT-C results, patient-reported health statuses, patients' satisfaction with their care experiences, and patient disease-specific clinical outcomes.

This study was conducted in two parts: mining of patient health records and administration of the questionnaire. The Lienjiang County Health Bureau provides an annual

integrated health screening for local adult residents, which enabled the researchers to administer the questionnaire without difficulty. We expected to survey more than 30% of relevant residents. The two parts of the study process are listed below:

a. Data was mined from the results of integrated health screenings in Lienjiang County over the period from2016 to 2017.

b. Questionnaires were administered between May 20, 2017 and June 10, 2017.

The length of the interview was estimated to take approximately 25 minutes. An interview guideline was developed for the workers in charge of administering the questionnaire. The guidelines covered the following:

1. Demographics of participants
2. Hospital-based or community-based primary care profile
3. Specialty of PCP
4. Self-reported health status of chronic disease
5. Primary Care Quality (PCAT)
6. Out-of-pocket medical payment
7. Satisfaction with care experience

We administered the PCAT-C, which was modified from the English version as shown in the Appendix. The English version includes 12 indicators and 59 items used to identify

the primary care provider (PCP), first-contact utilization, first-contact access, ongoing care, coordination, comprehensiveness (services provided), family-centeredness, community orientation, and other information about PCPs, specialist visits or special services, health status and awareness, and socioeconomic status (Yang, 2013).

Following completion of the integrated health screening, the questionnaires were analyzed. Laboratory data was completed after one month and analysis using statistics tools required an additional month. Our plan was to trace back through laboratory data for two years to identify changes associated with individual participants. The data was be examined for one more month and the survey was completed three months afterwards.

3.3.4 Identifying relevant domains for characterization

The original PCAT-AE includes seven domains, represented by ten scales. Each of the four core domains is represented by two components (facilities provided by the service organization and behavior of the provider and consumer). There are also three related domains. The edition of PCAT-C used in this study includes six domains, represented by seven scales. The core domain (first-contact) is represented by two components. When using the PCAT-AE, achievement of primary care is the cardinal domain of primary care.

The first domain of PCAT-AE concerns regular source of care (first-contact: accessibility) and the consistent use of that source when care was last required (first-contact: use) (Cassady, 2000). First-contact care refers to the accessibility of services to deal with each new problem or each new episode of a problem for which people seek health care. A facility does not provide first-contact care unless its potential users know it to be accessible and use it. Better access to a primary care physician therefore promotes both first-contact care and continuity (Forrest, 1998).

The second domain is used to assess the service provided by PCPs, the quality of communication between patients and PCPs (longitudinality: extent of affiliation), and the nature of the relationship with the source of care (longitudinality: relationship). Longitudinality refers to the existence of a regular source of care and the characteristics of the interpersonal relationship between that source of care and the patients. Thus, the primary care unit must be able to identify a suitable population, and individuals in that population should seek care from that unit, except in situations requiring outside consultation and/or referral.

The third domain deals with the range of services that are available (comprehensiveness: services available) and the actual administration of these services (comprehensiveness: services provided). Primary care facilities should be able to arrange for all types of health

care services, including referrals to secondary services for consultation, tertiary services for specific conditions, and support services, such as home care and other community services. The staff of a primary care facility should also be able to provide preventative services and deal with patient symptoms and apparent illnesses.

The fourth domain refers to the actual integration of services between primary care and specialty care (coordination). This requires a form of continuity, such as consultation with a specialist, as well as the transfer of medical records and the integration of primary care into the total care of patients. Recognition of the patient's problem can be facilitated simply by having the same practitioner engage in follow-up and having problems marked in medical records.

We also included the three other domains of family centeredness, community orientation, and cultural competence. Nonetheless, they are considered derivative in regard to their relationship with the major domains. Community orientation refers to the familiarity and involvement of health care providers in the needs of the community. Due to the ethnic homogeneity of the study population, the topic of cultural competence was excluded from this study.

3.3.5 Dependent Variables

The dependent variables included patient-reported health status, patients' satisfaction with their care experience, and patient disease-specific clinic outcomes. In terms of health status, we used patient-reported health status. Patient disease-specific clinical outcomes, such as central obesity, TG level, HDL-cholesterol, blood pressure, and plasma glucose, were identified through physical checkup records.

3.3.6 Independent variables

All participants took the PCAT-C questionnaire. All information was obtained directly from patients or the clinic health records at the CHC or local hospital. First-contact utilization included seven questions describing the source of care that was first used to deal with the health problem. First-contact accessibility included two questions indicating the ability to access the source of care. Eight questions dealt with the nature and strength of longitudinality associated with the source of ongoing care. Four questions addressed the coordination of services between the primary provider and specialty care. Eight questions pertaining to primary care addressed the comprehensiveness of the services provided. And finally, four items each were used to measure family-centeredness and community orientation. Other independent variables included sociodemographic data, including age, gender, work, education, family income, personal health status, and physician specialty (Appendix 1,2).

All questions were related to the patient's regular health provider and all items pertaining to the primary care domains were represented using a 4-point Likert-type scale: 1=definitely not; 2=probably not; 3=probably yes; 4=definitely yes. The item scores were averaged to a valid scale range of 1-4 (Haggerty, 2008). The summed score in each domain was obtained by adding the score of all items belonging to it after coding. When the "Don't Know/Cannot Remember' option was selected, there were three methods for treating it: missing value, median value of 2.5, and the imputation method. Imputation was used in this study due to the fact that it provides the highest internal consistency and reliability.

3.3.7 Analysis

In order to examine the psychometric properties of the PCAT, participants were classified into two groups. One group consisted of the total patient population and the other consisted of chronically ill patients that reported physical or psychiatric problems for one more year. Analysis of questionnaire results was performed for both total PCAT scores and individual domain scores to examine relative influence.

The reliability of the PCAT-C was assessed by measuring internal consistency reliability. Cronbach's α was used because each item on the PCAT-C has multiple ordered choices. Although the item correlation may be relatively high, they were analyzed with six factors or

domains in this study (consistent with previous study). Alpha's for the total score and six domains of the PCAT-C of the two groups were calculated (Morgan, 1993).

Factor analysis and construct validity were used in confirming the hypothesis supporting the composite score (Chan, 2009). The validity of study aim 1 was supported by content-related evidence and factorial evidence for construct-related evidence. The participants were separated into two groups of chronically ill patients and those without chronic conditions. In content-related evidence for validity, the definition for assessing primary care quality should be first established. The original edition of the PCAT-C was then revised into common words by the researcher and six scholars in Taiwan. For construct-related evidence for validity, the process of factorial evidence was used. The six-item domains were checked with factor analysis to determine whether they support the theory-based grouping of items. Evidence for measurement validity is listed in Table 1 (Morgan, 2001).

Table 1 Evidence for Measurement Validity (Morgan, 2001).

Type of Evidence	Usual Statistics	Support for Validity Depends On
Content		
All aspects of the construct are represented in appropriate proportions	None	Good agreement by judges about the content and its coverage
Construct		
Factorial-factor analysis yields a theoretically meaningful solution	Factor Analysis	Meaningful factor structure consistent with content evidence

Prior to statistical analysis, the adequacy of sample size was confirmed through power analysis. When sample size increases, the confidence interval becomes narrower. The risk level and upper and lower bounds of the confidence level should be estimated, and the required bound width and bound ration should be calculated. If the desired confidence level is 90%, the sample size of this study can be calculated under a required bound width or bound ration. Stata was used to calculate the sample size under the predicted assumptions. A table was created to look at the different sample sizes needed to detect different correlations (r=0.5 or 0.7) or differences/effect sizes for groups for alpha=0.05 and power=80% (Table 2).

Table 2. Estimated sample sizes under different correlations.

Example	1	2	3
Correlation(r)	0.3	0.5	0.7
Sample size	67	23	11

* α =0.05; power=80%=0.8

The hypothesis in study aim 2 was evaluated with null hypothesis significance testing (NHST) (Gliner, 2002). Analysis of variance (ANOVA) was used to evaluate the association between domains of primary care quality and patient-reported health status, patients' satisfaction with their care experience, and patient disease-specific clinical outcomes. Significant differences between the general patient population and chronically ill patient population were listed (Cote, 2007). The association between sociodemographic factors and domains of primary care quality was analyzed using multiple regression.

Sociodemographic and health care utilization measures were compared to the groups with different patient-reported health statuses, those with different patients' satisfaction with their care experience, and those with different patient disease-specific clinical outcomes. Comparisons of discrete and overall primary care attributes were analyzed

to identify the independent predictors of different scale responses. Differences in the mean were determined using a t-test, and comparison after adjustments was made for sociodemographic and health care covariates using a multivariate analysis of variance. Independent variables were characterized into two blocks related to the results of the PCAT-C. Stepwise regression analysis was used to identify the strongest variables in each block and to add blocks in order one by one. When attributes from different dimensions were highly correlated (i.e., could not contribute independently), we selected the variable with the strongest association. This association was modifiable because organizational dimensions are highly correlated in the definition of functional models.

Descriptive statistics were obtained from the PCAT-C, including the mean, standard deviation, range, percentile, skewness, kurtosis, and inter-scale correlation. Continuous variables were centered at the mean value. The distribution of all items in the domain of first contact were described, and the mean and standard error of each item were calculated using the imputation method for non-responses outlined above. Patients who do not visit a specialist did not answer the coordination questions, and analysis was performed to differentiate the results obtained with and without those questions. The global index for primary care evaluation was compared as the sum of 36 items; i.e., 36-144. To enable further

interpretation, the score was transformed to a score of 0-100 points [score=100 X (sum-36)/ (144-36)] with the higher scores indicating superior primary care performance.

Patient satisfaction in resource-intensive clinics was expected to be higher than in resource-thrifty clinics (Margolis, 2003). Patient-reported health status, patients' satisfaction with their care experience and patient disease-specific clinical outcomes were described and compared with results of the PCAT-C using F-statistics (analysis of variance) and linear regression analysis, and then adjusted according to gender, age, monthly family income, clinical setting, and physician specialty.

All analyses were performed using the statistical package STATA 12.

CHAPTER 4. RESULTS

The sociodemographic characteristics of all participants were analyzed. The study aims described in the research objectives were then analyzed one by one. In order to examine the psychometric properties of the PCAT, participants were classified into two groups: a chronically ill patient population comprising of individuals who have self-reported physical or psychiatric problems for at least one year and a non-chronically ill patient population.

4.1 Respondent Characteristics

The sociodemographic characteristics of participants are analyzed in Table 3. There were 2,913 participants with participation rate of 34.65%. The gender ratio of female to male was 51.13% to 48.87% in participants and 41.97% to 58.03% (3528:4879) in the study population. The participation rate was higher for females, implying females are more concerned about their health. The participants were all over 30 years old and the ratio of high school to higher education was 58.15% (1,694/2,913). The percentage of individuals who were fully employed was 39.17% (1,141/2,913), and the percentage of unemployed individuals was 30.34% (884/2,913), including most housekeepers and elderly residents. About 45.79% (1,334/2,913) of participants had monthly household incomes of USD $1,667 or under, and 43.36% (1,263/2,913) of participants had higher incomes. The percentage of individuals who

resided in Nangan Township was 64.16% (1,869/2,913). Because no health center currently exists in Nangan Township, residents receive primary care at the local hospital.

The percentage of patients with chronic disease was 35.50% (1,034/2,913). A comparison of patients with and without chronic disease is also shown in Table 3. There were some significant differences between the two groups, such as in regards to education level, age, employment, household income, and island of residence. More male participants had chronic disease than females, and individuals with chronic disease were less educated and older than those who did not have chronic disease. Individuals with chronic disease also had a higher percentage of unemployment or retirement, lower income, and likelihood of living outside of Nangang island.

Table 4 reveals the relationship between chronic disease and patient education and income. Patients with lower education levels (lower than high school) had higher rates of chronic disease (p=.0001), and patients with lower household incomes (lower than 1,999 USD) also had higher rates of chronic disease (p=.0045).

Table 3. Characteristics of study subjects

		All		Chronic			
		Total	%	With Chronic Illness	%	Without Chronic Illness	%
Education							
	Less	1007	37.72	530	55.15	477	27.91
	High School	699	26.18	240	24.97	459	26.86
	Graduate/Coll	777	29.10	158	16.44	619	36.22
	Postgraduate	187	7.00	33	3.43	154	9.01
	Total	2670*	100.00	961	100.00	1709	100.00
Gender							
	Male	1390	49.00	601	58.63	789	43.54
	Female	1447	51.00	424	41.37	1023	56.46
	Total	2837	100.00	1025	100.00	1812	100.00
Age							
	<30	533	18.79	43	4.20	490	27.04
	30-39	670	23.62	118	11.51	552	30.46
	40-49	751	26.47	265	25.85	486	26.82
	50-59	582	20.51	357	34.83	225	12.42
	60-69	301	10.61	242	23.61	59	3.26
	Total	2837	100.00	1025	100.00	1812	100.00
Occupation							
	Civil Servant	796	30.02	195	20.42	601	35.42
	Farmer Fisher	86	3.24	44	4.61	42	2.47
	Business	529	19.95	210	21.99	319	18.80
	Others	1241	46.79	506	52.98	735	43.31
	Total	2652	100.00	955	100.00	1697	100.00
Job Status							
	Entrepreneur	296	11.83	110	12.39	186	11.52
	Full Time	1116	44.60	270	30.41	846	52.42
	Part Time	216	8.63	64	7.21	152	9.42
	Other	874	34.93	444	50.00	430	26.64
	Total	2502	100.00	888	100.00	1614	100.00
Household Income (USD)							
	1,999	1317	51.43	523	58.37	794	47.69
	2,000-3,666	855	33.39	261	29.13	594	35.68
	3,667-5,333	220	8.59	58	6.47	162	9.73
	5,334-6,999	62	2.42	23	2.57	39	2.34
	7,000-	107	4.18	31	3.46	76	4.56
	Total	2561	100.00	896	100.00	1665	100.00
Living							

Nangan	1815	63.98	621	60.59	1194	65.89
Beigan	469	16.53	165	16.10	304	16.78
Juguang	257	9.06	113	11.02	144	7.95
Dongyin	296	10.43	126	12.29	170	9.38
Total	2837	100.00	1025	100.00	1812	100.00

**Different totals are due to missing data.*

Table 4. Relationship between chronic disease and education and income

Health Status (num/%)	Education Level*			Income**		
	Low (n= 1,706)	High (n=964)	p-value	Low (n=1,317)	High (n=1,244)	p-value***
With chronic disease	770	191	<.0001	784	112	0.0045
No chronic disease	947	778		1399	281	

**Education level was divided into low and high groups (above college).*

***Income level was divided into low and high groups (above USD 2,000 per month).*

****Represents the significance ($p<0.05$) by x^2-test.*

4.2 Reliability and Validity of the PCAT, Taiwan Edition

The reliability domain includes three components: reliability, internal consistency, and measurement error. Assessment of internal consistency can be done by calculating the coefficient, Cronbach's α, using statistical software (Wang, 2014). For domains 1-7, Cronbach's α's range from 0.64 to 0.87 for both the total sample and the chronically-ill sub-sample (see Table 5). The mean values of the PCAT domains are also presented for the two samples.

Table 5. Mean scores and internal consistency of Domains 1-7 of PCAT-C, Taiwan edition

Domains	All patients				Chronic illness group			
	Mean	SD	Cronbach α (raw)	Cronbach α (Standardized)	Mean	SD	Cronbach α (raw)	Cronbach α (Standardized)
Identify primary care provider	5.64	1.01	0.69	0.69	5.90	1.01	0.74	0.76
First contact (utilization)	5.78	1.00	0.74	0.74	5.99	1.00	0.79	0.79
First contact (access)	19.07	2.45	0.64	0.63	19.46	2.43	0.64	0.65
Ongoing care	22.22	2.16	0.68	0.71	22.56	2.19	0.70	0.74
Coordination	11.83	1.54	0.83	0.84	12.06	1.67	0.87	0.88
Comprehensiveness (Services provided)	18.10	2.14	0.69	0.68	18.89	2.03	0.68	0.68
Family-centeredness	11.01	1.81	0.83	0.83	11.32	1.87	0.86	0.86
Community orientation	9.28	1.78	0.87	0.87	9.56	1.81	0.87	0.87

Factor loadings of the PCAT by confirmatory factor analysis were completed; the results are shown in Table 6a. Factor loadings for the dimensions ranged from 0.3841 to 0.8447. Community orientation had the focused and highest factor loading (0.7438 to 0.8447), while comprehensiveness (service provided) had the disparate and lowest factor loading (0.3841 to 0.7718). Similar confirmatory factor analysis was also performed using patients with chronic conditions only and resulted in similar findings (see Table 6b).

Construct validity refers to the degree to which a measure's score supports the inference that the construct represents. Structural validity is considered one aspect of construct validity, and was performed using confirmatory factor analysis (CFA) (Polit, 2015). Seven factors were listed and analyzed according to the seven domains of the PCAT questionnaire: first contact (utilization), first contact (access), ongoing care, coordination, comprehensiveness (services provided), family-centeredness, and community orientation.

Questions 1 through 5 belonged to factor 1, first contact (utilization). Questions 6 through 8 and questions 9 to 11 belonged to first contact (access). These were divided into factors 2 and 3 by factor analysis. Questions 12 through 15 and 17 through 19 belonged to factor 4, ongoing care. Question 16, regarding out-of-pocket payments of ongoing care was not clearly clarified with factor 1, community orientation, because there were almost zero

Table 6a. Factor loadings of Domains 1-7 on the PCAT-C, Taiwan edition, by confirmatory factor analysis (total sample)

Factor Pattern	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7
qac1	0.49795	-0.24054	0.40098	-0.24076	0.06826	-0.26673	0.07967
qac2	0.6292	-0.12634	0.28616	-0.27192	0.00759	-0.20088	-0.06379
qac3	0.55601	-0.1497	0.4084	-0.26396	0.08886	-0.29133	-0.00255
qac4	0.51786	-0.22205	0.38394	-0.19826	0.14334	-0.37212	0.03582
qac5	0.46374	-0.21115	0.33482	0.20934	-0.12053	0.00155	0.13205
qac6	0.56787	-0.14925	0.25279	0.30073	-0.0587	0.06483	0.14721
qac7	0.54844	-0.02969	0.32321	0.29776	-0.15389	0.13853	0.10989
qac8	0.48097	-0.09755	0.31215	0.3879	-0.15093	0.16995	0.19068
qac9	0.4092	-0.14385	0.23656	0.37913	-0.16074	0.15999	0.05017
qac10	-0.08606	0.09759	0.19893	0.06346	0.61461	0.24345	0.35773
qac11	-0.23987	0.38776	0.21329	0.0109	0.54735	0.1485	0.08015
qac12	0.22846	0.10483	0.18554	-0.00599	0.12067	0.28411	-0.46016
qac13	0.56758	-0.27969	-0.02798	0.13979	0.04224	0.1064	-0.14046
qac14	0.55393	-0.11018	0.13047	0.11209	-0.06758	0.10769	-0.25943
qac15	0.5662	-0.29175	-0.07442	0.11936	0.08795	0.03935	-0.22052
qac16	0.40221	0.20309	-0.02442	0.10996	0.08243	-0.07777	-0.36405
qac17	0.61035	-0.05904	-0.05436	0.03745	0.00977	0.05567	-0.33844
qac18	0.37038	-0.15444	-0.11797	0.04468	0.02954	0.31156	0.09904
qac19	0.61522	-0.22214	-0.07766	-0.01485	0.21624	-0.04077	-0.12377
qac20	0.6487	-0.20908	-0.26913	0.07944	0.23071	-0.06502	-0.06895
qac21	0.59514	-0.29685	-0.30163	0.06856	0.26723	-0.03665	-0.01247
qac22	0.64945	-0.14427	-0.31619	0.10703	0.20268	-0.03372	-0.00333
qac23	0.60288	0.03352	-0.28246	0.10993	0.13699	-0.06057	0.03585
qac24	0.65999	0.05446	-0.25179	0.10403	0.04791	-0.08425	0.0842
qac25	-0.03181	0.52586	0.24147	0.02464	0.32644	0.05803	-0.11618
qac26	0.4042	0.4404	-0.0658	0.03915	0.00032	-0.0736	0.11061
qac27	0.47598	-0.14419	-0.14924	-0.0775	0.10197	0.06718	0.23279
qac28	0.54562	-0.00221	0.04657	-0.46281	-0.14005	0.35362	0.00523
qac29	0.50218	0.05491	0.08511	-0.47435	-0.10699	0.41277	0.01217
qac30	0.53457	0.06297	-0.00763	-0.39068	-0.04019	0.23392	0.04192
qac31	0.64807	0.07953	-0.20203	-0.16318	-0.07826	-0.00182	0.16475
qac32	0.64147	0.14459	-0.22906	-0.05133	-0.06407	-0.02601	0.17821
qac33	0.62486	0.15745	-0.25928	-0.09621	-0.07637	-0.05199	0.1662
qac34	0.61244	0.24934	-0.13847	-0.0245	-0.14678	-0.06087	0.1416
qac35	0.44838	0.61999	0.0813	0.01321	-0.03988	0.00039	-0.04203
qac36	0.44065	0.65834	0.12157	0.02346	-0.10317	-0.02214	-0.09537
qac37	0.48295	0.51613	-0.0523	0.11029	-0.06825	-0.17981	0.00323
qac38	0.46214	0.64333	0.03152	0.13502	-0.06209	-0.11703	-0.00855

Note: 7 factors were retained by the MINEIGEN criterion. Variance explained by each factor

Factor1	*Factor2*	*Factor3*	*Factor4*	*Factor5*	*Factor6*	*Factor7*
10.236418	2.975032	1.862823	1.53985	1.278711	1.141613	1.068442

Table 6b. Factor loadings of Domains 1-7 on the PCAT-C, Taiwan edition, by confirmatory factor analysis (chronically ill sample)

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7
qac1	0.5974	-0.24653	0.31567	0.3166	-0.04623	-0.12559	-0.09589
qac2	0.66767	-0.0825	0.24323	0.27969	-0.14654	-0.19367	0.00404
qac3	0.61192	-0.13413	0.3511	0.342	-0.11703	-0.18742	0.04948
qac4	0.5862	-0.1649	0.33069	0.27842	-0.10237	-0.1907	0.04367
qac5	0.56574	-0.21066	0.36855	-0.08183	-0.0461	-0.09315	-0.15109
qac6	0.64459	-0.1248	0.30104	-0.18286	-0.02489	0.02278	-0.09284
qac7	0.57877	-0.05093	0.34478	-0.2827	-0.19706	0.0042	-0.16136
qac8	0.51544	-0.08841	0.38801	-0.31925	-0.11292	0.23835	-0.10188
qac9	0.44698	-0.15167	0.29216	-0.34191	0.05925	0.26495	-0.10702
qac10	-0.09115	0.14079	0.29026	0.24087	0.61298	0.33121	-0.27461
qac11	-0.3465	0.40833	0.29154	0.18492	0.44778	0.03354	-0.02746
qac12	0.18018	0.15588	0.22262	-0.07941	0.15552	0.34333	0.67572
qac13	0.66804	-0.17775	0.0357	-0.12138	0.15498	0.0402	0.03905
qac14	0.59126	-0.077	0.15597	-0.07475	-0.04418	0.17433	0.27183
qac15	0.68945	-0.24279	-0.03948	-0.13538	0.13289	0.0073	0.16054
qac16	0.3504	0.28452	0.09363	-0.15625	0.01139	-0.2787	0.22469
qac17	0.67729	-0.08918	-0.05707	-0.03578	0.0497	-0.11065	0.287
qac18	0.50251	-0.16298	-0.0742	-0.14784	0.08635	0.15487	-0.25675
qac19	0.69967	-0.20503	-0.00026	0.02187	0.24555	-0.09794	0.10985
qac20	0.72714	-0.07928	-0.1791	-0.05168	0.25958	-0.2083	0.03788
qac21	0.69523	-0.17201	-0.23664	-0.05016	0.29189	-0.25301	-0.01427
qac22	0.72263	-0.048	-0.25827	-0.0899	0.22565	-0.18981	-0.05209
qac23	0.63333	0.06545	-0.22246	-0.14133	0.14798	-0.17367	-0.08421
qac24	0.66398	0.12385	-0.26912	-0.09622	0.05432	-0.03774	-0.03199
qac25	-0.20868	0.52009	0.25886	0.09014	0.24203	-0.12814	0.03786
qac26	0.29949	0.5152	-0.06249	-0.00193	-0.16815	0.0888	0.09673
qac27	0.57962	-0.1661	-0.1645	0.10507	0.11042	0.16439	-0.05242
qac28	0.58945	-0.02081	-0.15383	0.34326	-0.13401	0.16192	0.05848
qac29	0.55178	-0.05542	-0.10781	0.34689	-0.08716	0.25974	0.02201
qac30	0.59271	0.05309	-0.15753	0.31632	-0.03577	0.19849	-0.01637
qac31	0.66898	0.08215	-0.22627	0.1563	-0.04238	0.16996	-0.03198
qac32	0.66556	0.17874	-0.20221	-0.00532	-0.12326	0.20972	-0.10409

qac33	0.67495	0.20795	-0.218	-0.00536	-0.09014	0.17362	-0.06476
qac34	0.64599	0.30909	-0.15312	-0.02999	-0.06577	0.10966	-0.09375
qac35	0.38111	0.65128	0.05464	0.01711	-0.06226	-0.11939	-0.19025
qac36	0.33928	0.7032	0.11072	0.00537	-0.10642	-0.03579	-0.03239
qac37	0.42746	0.59016	0.01694	-0.07058	-0.02305	-0.06741	0.02535
qac38	0.36945	0.71635	0.07699	-0.09314	-0.0267	-0.07283	-0.00643

out-of-pocket payments during regular medical visits on these offshore islands. Questions 20 to 23 belonged to factor 2, coordination. Family-centeredness was addressed in questions 31 to 34. Questions 24 to 30 belonged to factor 6, comprehensiveness (service provided), but question 24 was classified to factor 2 and questions 25 and 26 were classified to factor 1 separately by factor analysis. They still had discriminant validity with other questions as evidenced by the validity coefficient. Questions 35 to 38 belonged to factor 1, community orientation. In sum, the PCAT is a valid, reliable and responsible tool with psychometric properties in the multidimensional quantification of primary health care, similar to previous work (Qazi, 2016). The Taiwan edition of the PCAT performed successfully in the Taiwanese context and was used with confidence. First contact was divided to three parts and is the most discriminating health service experience of primary care. It is a crucial dimension of patient evaluation (Jeannie, 2011).

4.3 Descriptive Statistics of Primary Care Quality

Table 7 provides the descriptive statistics of primary care quality as captured by the Taiwan version of PCAT after the validity and reliability test. A total of eight domains were captured including the four cardinal domains of primary care: first contact – utilization, first contact – accessibility, ongoing care, coordination, and comprehensiveness. In addition, the two

Table 7. Score distribution of the PCAT-AE (Mandarin Chinese, Taiwan short version)

	All			Chronic illness			Nonchronic illness			P
Item	N	Mean*	SD	N	Mean	SD	N	Mean	SD	
Utilization	2636	5.78	1.00	950	5.99	1.00	1686	5.65	0.97	<.0001
Accessibility	1669	19.07	2.45	648	19.46	2.43	1021	18.83	2.43	<.0001
Ongoing care	1849	22.22	2.16	706	22.56	2.19	1143	22.01	2.12	<.0001
Coordination	2030	11.83	1.54	772	12.06	1.67	1258	11.69	1.43	<.0001
Comprehensiveness	1807	18.10	2.14	643	18.89	2.03	1164	17.66	2.07	<.0001
Family-centeredness	1790	11.01	1.81	678	11.32	1.87	1112	10.82	1.74	<.0001
Community orientation	1607	9.28	1.78	592	9.56	1.81	1015	9.11	1.75	<.0001
Overall PCAT scale	907	97.68	8.77	346	99.69	8.55	561	96.45	8.68	<.0001

*The summation of overall PCAT score of each participants is from 38 to 152.

derivative domains of family-centeredness and community orientation were also included. Finally, the overall primary care quality was represented by the total PCAT score which summarized all the seven domains. As can be seen from the table, the chronically-ill sample performed better on all primary care domains.

4.4 Associations between Primary Care and Patient Outcomes

The second study aim was to examine the associations between the domains of primary care quality and patient outcomes. Research hypothesis H3 was to prove that better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. are significantly associated with better patient-reported health status.

Subjective health status was defined as having chronic disease or not. If patients had chronic diseases such as hyperglycemia, hypertension, hyperlipidemia, cerebrovascular disease, cardiovascular disease, chronic renal disease, chronic liver disease, malignancy, and psychiatric disease, they would be classified as having poor health status. Health status was related to socioeconomic factors, such as age, job status, household income, and education level (Table 8). Younger patients had better reported health status ($p<0.0001$). Those with household incomes >5,334 USD ($p=0.0164$) and had high education level ($p<0.0368$) also had good health status.

Table 8. Associations between patient socioeconomic factors and health status.

	B	SE	P	OR	95% CI Lower	Upper
Intercept	-2.3063	0.1955	<.0001			
Age						
30-39	Ref					
40-49	0.8679	0.1973	<.0001	2.382	1.618	3.506
50-59	1.7305	0.1911	<.0001	5.644	3.881	8.208
60-69	2.8146	0.2008	<.0001	16.686	11.258	24.731
>70	3.7356	0.2563	<.0001	41.913	25.363	69.262
Job Status						
Part time or others	Ref					
Entrepreneur or full time	-0.1106	0.1073	0.303	0.895	0.725	1.105
Household Income						
<=1,999	Ref					
2,000-5,333	0.1672	0.1131	0.1393	1.182	0.947	1.475
>=5,334	0.5168	0.2154	0.0164	1.677	1.099	2.557
Education Level						
High School or below High School or Below	Ref					
Graduate/College or Above	-0.265	0.1269	0.0368	0.767	0.598	0.984

Ps1. Logistic regression was used

Ps2. OR: Odds Ratio

Ps3. B:regression coefficient;
SE: standard error;

Ps4. Subjective health status was defined as having chronic disease or not.

Table 9 compares the primary care quality domains between those with and without chronic conditions. For each primary care domain, we further categorized the measure into three groups: lower level of fulfilment (lower), average level of fulfilment (average), and higher level of fulfilment (optimal). As can be seen from the table, those with chronic conditions performed better than those without in all the primary care domains.

Regression analysis was performed assessing the relation between primary care performance (i.e., total PCAT score coded as continuous) and chronic condition status controlling for patients' sociodemographic characteristics (Table 10). Those with chronic conditions experienced better primary care than those without even after controlling for patient sociodemographic characteristics ($p<.001$). The most significant differences were in utilization, accessibility, coordination, and comprehensiveness. For the group with chronic disease, first contact, coordination, and comprehensiveness were most important for long-term care convenience. For the group without chronic disease, the information getting from community orientation activity may become important but there were no statistically significant differences. This indicates more patients should be encouraged to participate in health literacy activities in the community hereafter. Total sample values were less than combined values of single items because of missing data.

Other sociodemographic measures were also analyzed. The most important item was patient education where differences in primary care quality were felt. The least important items were gender and job status. Primary care quality was equal between entrepreneurs and employees. Because individuals under 49 years of age received fewer health services, no difference existed in their health service quality tests. For residents older than 50 years of age, the percentage with chronic disease increased. Experience of primary care was therefore associated with age.

The same regression was repeated after adding an interaction term (age and education) and the result was identical: those with chronic conditions experienced better primary care than those without ($p<.001$) (see Table 11).

Because PCAT score was not normally distributed, logistic regressions were also performed to examine the relationship between primary care (optimal versus non-optimal) and chronic condition status controlling for sociodemographics (Table 12). The results showed that in both unadjusted and adjusted models, those with chronic conditions experienced more optimal primary care than those without ($p<001$ and $p<.05$, respectively). There was no association between socioeconomic factors and primary care quality measurement with the exception of age ($p<0.0001$). However, age was not associated after adjustment ($p=0.2764$).

Table 9. Score distribution of the PCAT-AE (Mandarin Chinese, Taiwan short version)

Item	Level	No chronic disease	%	With chronic disease	%	Total	P-value
Utilization							<.0001
	Lower (<4)	19	63.33	11	36.67	30	
	Medium (4-6)	1534	65.78	798	34.22	2332	
	Optimal (>6)	133	48.54	141	51.46	274	
	Total	1686	63.96	950	36.04	2636	
Accessibility							<.0001
	Lower (<14)	25	73.53	9	26.47	34	
	Medium (14-21)	920	62.71	547	37.29	1467	
	Optimal (>21)	76	45.24	92	54.76	168	
	Total	1021	61.17	648	38.83	1669	
Ongoing care							0.0283
	Lower (<16)	9	75.00	3	25.00	12	
	Medium (16-24)	1079	62.44	649	37.56	1728	
	Optimal (>24)	55	50.46	54	49.54	109	
	Total	1143	61.82	706	38.18	1849	
Coordination							<.0001
	Lower (<8)	8	66.67	4	33.33	12	
	Medium (8-12)	1145	63.79	650	36.21	1795	
	Optimal (>12)	105	47.09	118	52.91	223	
	Total	1258	61.97	772	38.03	2030	
Comprehensiveness							<.0001

	Lower (<14)	12	92.31	1	7.69	13
	Medium (14-21)	1133	65.08	608	34.92	1741
	Optimal (>21)	19	35.85	34	64.15	53
	Total	1164	64.42	643	35.58	1807
Family centeredness						0.0003
	Lower (<8)	10	71.43	4	28.57	14
	Medium (8-12)	1051	63.24	611	36.76	1662
	Optimal (>12)	51	44.74	63	55.26	114
	Total	1112	62.12	678	37.88	1790
Community orientation						0.4127
	Lower (<8)	38	71.70	15	28.30	53
	Medium (8-12)	968	62.90	571	37.10	1539
	Optimal (>12)	9	60.00	6	40.00	15
	Total	1015	63.16	592	36.84	1607
Overall PCAT scale						0.0042
	Lower (<72)	4	100.00	0	0.00	4
	Medium (72-108)	539	62.75	320	37.25	859
	Optimal (>108)	18	40.91	26	59.09	44
	Total	561	61.85	346	38.15	907

*Chi-squared test, test differences in the proportion of different quantiles of the score.

Table 10. Association between primary care quality and chronic disease**

	Unstandardized		Standardized		t	P
	B	S.E.	B	S.E.		
Intercept	96.929	0.729	0.000	0.729	133.02	<.0001
Health Status (ref: no chronic disease)						
with chronic disease	2.234	0.402	0.122	0.402	5.55	<.0001
Age (Ref: 30-39)*						
40-49	0.477	0.505	0.024	0.505	0.95	0.3446
50-59	2.053	0.537	0.103	0.537	3.82	0.0001
60-69	3.533	0.645	0.161	0.645	5.48	<.0001
>70	4.772	0.850	0.156	0.850	5.62	<.0001
Job Status (Ref: Entrepreneur)						
Full Time	-0.588	0.558	-0.034	0.558	-1.05	0.2924
Part Time	-0.519	0.751	-0.017	0.751	-0.69	0.4898
Others	-1.103	0.572	-0.060	0.572	-1.93	0.0539
Household Income (Ref: <1999)						
2,000-3,666	-0.853	0.398	-0.046	0.398	-2.15	0.032
3,667-5,333	-0.276	0.654	-0.009	0.654	-0.42	0.6728
5,334-6,999	1.261	1.107	0.022	1.107	1.14	0.2547
>7,000	1.258	0.869	0.029	0.869	1.45	0.1477
Education (Ref: Less)						
High School	-2.273	0.478	-0.115	0.478	-4.76	<.0001
Graduate/College	-2.745	0.536	-0.145	0.536	-5.12	<.0001
Postgraduate	-2.645	0.792	-0.078	0.792	-3.34	0.0008

*Multiple linear regression.

** chronic diseases was defined as having hyperglycemia, hypertension, hyperlipidemia, cerebrovascular disease, cardiovascular disease, chronic renal disease, chronic liver disease, malignancy, and/or psychiatric disease.

Table 11. Association between PC quality and chronic disease with interaction term

	Unstandardized		Standardized		t	P
	B	S.E.	B	S.E.		
Intercept	94.860	0.666	0.000	0.666	142.45	<.0001
Health Status (ref: no chronic disease)						
with chronic disease	2.263	0.408	0.124	0.408	5.54	<.0001
Gender (Ref: male)						
Female	0.672	0.346	0.039	0.346	1.94	0.0523
Age (Ref: 30-39)						
40-49	0.028	0.578	0.001	0.578	0.05	0.9614
50-59	1.551	0.674	0.078	0.674	2.3	0.0215
60-69	3.598	0.744	0.164	0.744	4.83	<.0001
>70	5.299	0.865	0.174	0.865	6.12	<.0001
Job Status (Ref: part time or others)						
Full time or entrepreneur	0.541	0.380	0.031	0.380	1.42	0.1545
Household Income (Ref: <1,999)						
2,000-5,333	-0.979	0.379	-0.056	0.379	-2.58	0.0099
>=5,334	1.098	0.710	0.031	0.710	1.55	0.122
Education (Ref: High school or below)						
Graduate/College or above	-4.838	1.872	-0.269	1.872	-2.58	0.0098
Interaction						
Age (year) * Education (Graduate/College or above)	0.074	0.039	0.187	0.039	1.93	0.0539

Ps1. Multiple linear regression; Ps2. R: ; Ps3.adjusted R2:

Table 12. Ordinal logistic regression analysis of PCAT domain scores

Patient Characteristics	Unadjusted				Adjusted			
	OR*	95% CI		P	OR	95% CI		P
Health Status (ref: no chronic disease)								
with chronic disease	2.64	1.44	4.82	0.0017	2.23	1.00	4.95	0.0487
Gender (Ref. male)								
Female	1.18	0.66	2.12	0.5773	1.32	0.69	2.53	0.4025
Age (Ref:30-39)								
40-49	1.02	0.66	1.57	0.9246	2.12	0.68	6.58	0.1954
50-59	1.61	1.06	2.45	0.0258	1.86	0.55	6.30	0.3176
60-69	2.61	1.71	4.01	<.0001	2.06	0.53	8.00	0.2951
>=70	3.77	2.36	6.04	<.0001	2.34	0.51	10.77	0.2764
Job Status (Ref: part time or others)								
Full time or entrepreneur	0.60	0.33	1.09	0.0906	0.85	0.42	1.72	0.6533
Household Income (Ref:<1,999)								
2,000-5,333	1.00	0.52	1.90	0.9883	1.21	0.57	2.56	0.6214
>=5,334	1.11	0.35	3.53	0.8570	1.31	0.39	4.37	0.6649
Education (Ref: High school or below)								
Graduate/College or above	0.62	0.33	1.19	0.1521	1.16	0.49	2.76	0.7367

**In abbreviation. OR, odds ratio; CI, confidence interval*

***Note: The summation of overall PCAT score of each participant is from 38 to 152. PCAT score level is coded as: low:<76, medium:76-114; high:>114*

4.5 Associations between Primary Care and Patient Socioeconomic Characteristics

Hypothesis 4 (H4) under study aim 2 examines associations between primary care and patients' socioeconomic characteristics. Table 13 looks at the relationship between primary care quality and education level. As can be seen, those with lower level of education experienced better primary care quality in all the individual domains. The overall primary care scores were not statistically different between individuals with low- or high-level of education. However, this could be due to the coding method used where the majority of respondents were included in the medium category.

Table 14 looks at the relationship between primary care quality and household income level. As can be seen, those with lower household income experienced better primary care quality in all the individual domains except ongoing care, comprehensiveness, and community orientation where the differences were not statistically significant. The overall primary care scores were not statistically different between individuals with low- or high-level of household income. However, this could be due to the coding method used where the majority of respondents were included in the medium category.

Table 13. PC quality by education level

Item	Level	Low	%	High	%	Total	P-value
Utilization							<.0001
	Lower (<4)	20	71.43	8	28.57	28	
	Medium (4-6)	1335	60.49	872	39.51	2207	
	Optimal (>6)	202	76.23	63	23.77	265	
	Total	1557	62.28	943	37.72	2500	
Accessibility							<.0001
	Lower (<14)	13	44.83	16	55.17	29	
	Medium (14-21)	881	63.79	500	36.21	1381	
	Optimal (>21)	128	79.01	34	20.99	162	
	Total	1022	65.01	550	34.99	1572	
Ongoing care							0.0199
	Lower (<16)	6	54.55	5	45.45	11	
	Medium (16-24)	1016	62.22	617	37.78	1633	
	Optimal (>24)	80	75.47	26	24.53	106	
	Total	1102	62.97	648	37.03	1750	
Coordination							<.0001
	Lower (<8)	6	50.00	6	50.00	12	
	Medium (8-12)	1084	63.47	624	36.53	1708	
	Optimal (>12)	175	82.55	37	17.45	212	
	Total	1265	65.48	667	34.52	1932	
Comprehensiveness							0.0106
	Lower (<14)	4	33.33	8	66.67	12	
	Medium (14-21)	1026	61.92	631	38.08	1657	

	Optimal (>21)	40	76.92	12	23.08	52	
	Total	1070	62.17	651	37.83	1721	
Family centredness							<.0001
	Lower (<8)	8	57.14	6	42.86	14	
	Medium (8-12)	958	60.94	614	39.06	1572	
	Optimal (>12)	91	81.25	21	18.75	112	
	Total	1057	62.25	641	37.75	1698	
Community orientation							0.025
	Lower (<8)	25	47.17	28	52.83	53	
	Medium (8-12)	914	62.65	545	37.35	1459	
	Optimal (>12)	6	42.86	8	57.14	14	
	Total	945	61.93	581	38.07	1526	
Overall PCAT scale							0.3504
	Lower (<72)	2	50.00	2	50.00	4	
	Medium (72-108)	508	62.72	302	37.28	810	
	Optimal (>108)	32	72.73	12	27.27	44	
	Total	542	63.17	316	36.83	858	

Table 14. PC quality by household income level

Item	Level	Low	%	High	%	Total	P-value
Utilization							0.0032
	Lower (<4)	12	52.17	11	47.83	23	
	Medium (4-6)	1048	49.13	1085	50.87	2133	
	Optimal (>6)	150	60.48	98	39.52	248	
	Total	1210	50.33	1194	49.67	2404	
Accessibility							0.021
	Lower (<14)	15	48.39	16	51.61	31	
	Medium (14-21)	651	49.17	673	50.83	1324	
	Optimal (>21)	95	60.90	61	39.10	156	
	Total	761	50.36	750	49.64	1511	
Ongoing care							0.1627
	Lower (<16)	4	36.36	7	63.64	11	
	Medium (16-24)	776	49.02	807	50.98	1583	
	Optimal (>24)	54	58.06	39	41.94	93	
	Total	834	49.44	853	50.56	1687	
Coordination							0.0003
	Lower (<8)	6	50.00	6	50.00	12	
	Medium (8-12)	826	50.21	819	49.79	1645	
	Optimal (>12)	131	65.17	70	34.83	201	
	Total	963	51.83	895	48.17	1858	
Comprehensiveness							0.2493
	Lower (<14)	6	50.00	6	50.00	12	
	Medium (14-21)	795	49.63	807	50.37	1602	

	Optimal (>21)	28	62.22	17	37.78	45	
	Total	829	49.97	830	50.03	1659	
Family centeredness							0.0032
	Lower (<8)	7	50.00	7	50.00	14	
	Medium (8-12)	758	50.13	754	49.87	1512	
	Optimal (>12)	70	67.31	34	32.69	104	
	Total	835	51.23	795	48.77	1630	
Community orientation							0.0918
	Lower (<8)	20	37.74	33	62.26	53	
	Medium (8-12)	726	51.64	680	48.36	1406	
	Optimal (>12)	5	38.46	8	61.54	13	
	Total	751	51.02	721	48.98	1472	
Overall PCAT scale							0.5209
	Lower (<72)	1	25.00	3	75.00	4	
	Medium (72-108)	408	51.97	377	48.03	785	
	Optimal (>108)	19	48.72	20	51.28	39	
	Total	428	51.69	400	48.31	828	

Table 15 looks at the relationship between primary care quality and area of living where health care resources differ. As can be seen, there were significant differences in primary care quality among residents of different islands in Lienjiang county. This included access, ongoing care, coordination, comprehensiveness, and community orientation. The high***est*** overall PCAT scale was in the south island, **Juguang, and** middle island, **Nangan**. The ***lowest*** was in the north island, **Dongyin,** which is farthest from Nangang island and has the fewest medical resources. There are more medical resources in Nangang, so differences in the PCAT measurement were significant with other islands, especially in first contact (accessibility) and ongoing care. A high scale in Juguang may have been due to the small population and low medical demand.

Table 15. Comparison of primary care domains by living area

PC domains	Living area				P	P (Post test)					
	Beigan (1)	Dongyin (2)	Juguang (3)	Nangan (4)		P (1 vs.2)	P (1 vs.3)	P (1 vs.4)	P (2 vs.3)	P (2 vs.4)	P (3 vs.4)
First contact -utilization	5.83	5.62	5.65	5.79	0.0028	0.0165	0.077	0.8759	0.9806	0.0206	0.1199
First contact -accessibility	18.52	18.62	18.63	19.19	<.0001	0.9181	0.8986	<.0001	0.9998	<.0001	0.0003
Ongoing care	21.97	21.73	22.31	22.30	<.0001	0.4651	0.1866	0.0173	0.0109	0.0002	0.9999
Coordination -referral	11.87	11.42	11.83	11.80	<.0001	<.0001	0.9769	0.7357	0.0018	<.0001	0.989
Comprehensiveness	18.11	17.79	18.54	18.07	0.0002	0.155	0.0268	0.9865	<.0001	0.1232	0.0025
Family-centeredness	10.94	10.59	11.08	10.99	0.0003	0.014	0.661	0.8978	0.0015	0.0002	0.8575
Community orientation	9.42	9.06	9.70	9.27	<.0001	0.0036	0.0509	0.1562	<.0001	0.0938	<.0001
Overall PCAT scale	96.65	94.84	97.74	97.42	<.0001	0.0188	0.3387	0.2905	0.0003	<.0001	0.9384

Statistics: One way ANOVA to test significance between primary care domains and living area. Post-hoc (Turkey) test for mean differences across regions.

4.6 Satisfaction Analysis and Prediction from Primary Care Quality

Hypothesis 4 (H4) predicted that better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better patient satisfaction with their primary care experience. We first analyzed the association between sociodemographic characteristics and satisfaction with primary care experience (a five-point likert scale treated as a continuous measure) (Table 16). There were significant associations between primary care satisfaction and certain sociodemographic factors after controlling for patients' chronic disease health statuses. Being older than 70 years of age was significantly associated with primary care satisfaction. Having a college education or above was negatively associated with primary care satisfaction which is compatible with earlier findings. The relationship between education and primary care satisfaction was also confirmed in a further logistic regression analysis where satisfied was coded as 1 and not satisfied was coded as 0 (see Table 18). Job status, household income, and education level were not statistically significant. The interaction of age*education level was also not significantly associated (p=0.0827) (Table 17).

Table 18, 19 shows the association between PCAT quality and satisfaction for patients with chronic diseases such as hypertension, diabetes, and hyperlipidemia. Patients with chronic disease (OR 1.61) and patients with age older than 70 years old (OR 1.92) were more

satisfied. However, patients with higher education of college (OR 0.43) were less satisfied. Under unadjusted sociodemographic conditions, satisfaction was positively associated with all domains, especially first contact-utilization and coordination-referral. Under adjusted sociodemographic conditions, domains of ongoing care, coordination-referral, and family-centeredness were significantly associated with satisfaction ($p<0.0001$, $t>3.77$). Community orientation was negatively associated with satisfaction ($p< 0.0004$, $t < -3.56$) .

Table 16. Association between primary care satisfaction and socio-demographic factors after controlling for health status

	Unstandardized Coefficients		Standardized Coefficients		t	P
	B	S.E.	B	S.E.		
Intercept	3.043	0.026	0.000	0.026	117.81	<.0001
Health Status (ref: no chronic disease)						
with chronic disease	0.047	0.018	0.064	0.018	2.64	0.0083
Gender (Ref: male)						
Female	-0.007	0.015	-0.009	0.015	-0.44	0.6604
Age (Ref: 30-39)						
40-49	-0.021	0.022	-0.025	0.022	-0.93	0.3534
50-59	-0.006	0.024	-0.008	0.024	-0.27	0.786
60-69	0.025	0.027	0.028	0.027	0.93	0.3535
>70	0.083	0.034	0.069	0.034	2.41	0.016
Job Status (Ref: part time or others)						
Full Time or entrepreneur	0.010	0.017	0.014	0.017	0.61	0.5407
Household Income (Ref: <1,999)						
2,000-5,333	-0.001	0.017	-0.002	0.017	-0.07	0.9432
>=5,334	-0.004	0.031	-0.003	0.031	-0.13	0.8971
Education (Ref: High school or below)						
Graduate/College or above	-0.075	0.019	-0.104	0.019	-4.04	<.0001

Ps1. Multiple linear regression

Table 17. Association between primary care satisfaction and sociodemographic factors after controlling for health status and the interaction between age and education

	Unstandardized Coefficients		Standardized Coefficients		t	P
	B	S.E.	B	S.E.		
Intercept	3.067	0.029	0.000	0.029	104.67	<.0001
Health Status (ref: no chronic disease)						
with chronic disease	0.047	0.018	0.064	0.018	2.65	0.0081
Gender (Ref: male)						
Female	-0.005	0.015	-0.007	0.015	-0.31	0.7568
Age (Ref: 30-39)						
40-49	-0.042	0.025	-0.051	0.025	-1.66	0.098
50-59	-0.038	0.030	-0.047	0.030	-1.28	0.2023
60-69	-0.008	0.033	-0.009	0.033	-0.24	0.8135
>70	0.057	0.038	0.047	0.038	1.51	0.1318
Job Status (Ref: part time or others)						
Full Time or entrepreneur	0.013	0.017	0.019	0.017	0.8	0.4215
Household Income (Ref: <1,999)						
2,000-5,333	-0.003	0.017	-0.004	0.017	-0.18	0.8562
>=5,334	-0.003	0.031	-0.002	0.031	-0.1	0.9177
Education (Ref: High school or below)						
Graduate/College or above	-0.214	0.082	-0.295	0.082	-2.61	0.0092
Interaction						
Age (year) * Education (Graduate/College or above)	0.003	0.002	0.183	0.002	1.74	0.0827

Ps1. Multiple linear regression

Table 18. Ordinal logistic regression analysis on satisfaction

Patient Characteristics	Unadjusted				Adjusted			
	OR	95% CI		P	OR	95% CI		P
Health Status								
(ref: no chronic disease)								
with chronic disease	2.205	1.682	2.89	<.0001	1.61	1.16	2.25	0.0050
Gender (Ref: male)								
Female	0.918	0.71	1.187	0.5143	0.98	0.74	1.30	0.9088
Age (Ref: 30-39)								
40-49	1.021	0.662	1.574	0.9246	0.83	0.53	1.30	0.4230
50-59	1.612	1.059	2.453	0.0258	1.00	0.63	1.60	0.9949
60-69	2.614	1.705	4.007	<.0001	1.30	0.78	2.16	0.3195
>=70	3.773	2.357	6.04	<.0001	1.92	1.05	3.49	0.0338
Job Status								
(Ref: part time or others)								
Full time or entrepreneur	0.679	0.519	0.888	0.0047	1.11	0.82	1.52	0.4952
Household Income								
(Ref: <1,999)								
2,000-5,333	0.627	0.474	0.831	0.0011	0.91	0.66	1.24	0.5394
>=5,334	0.52	0.293	0.923	0.0255	0.83	0.45	1.52	0.5420
Education								
(Ref: High school or below)								
Graduate/College or above	0.342	0.25	0.466	<.0001	0.43	0.29	0.63	<.0001

In abbreviation: OR, odds ratio; CI, confidence interval

Table 19. Association between PCAT quality and satisfaction for patients with chronic disease

PCAT domains	Unstandardized coefficients		Standardized coefficients		t	P
	B	S.E.	B	S.E.		
Unadjusted						
First contact-utilization	0.13022	0.0108559	0.360221	0.010856	12.00	<.0001
First contact-accessibility	0.054384	0.0051124	0.323971	0.005112	10.64	<.0001
Ongoing care	0.080723	0.0040482	0.540192	0.004048	19.94	<.0001
Coordination-referral	0.11292	0.0066548	0.479375	0.006655	16.97	<.0001
Comprehensiveness	0.069041	0.0052342	0.390836	0.005234	13.19	<.0001
Family-centeredness	0.095804	0.0059958	0.457408	0.005996	15.98	<.0001
Community orientation	0.036003	0.0076092	0.150576	0.007609	4.73	<.0001
Adjusted						
First contact-utilization	0.017393	0.011771	0.048113	0.011771	1.48	0.14
First contact-accessibility	0.005714	0.005402	0.034038	0.005402	1.06	0.29
Ongoing care	0.04654	0.006184	0.311445	0.006184	7.53	<.0001
Coordination-referral	0.034658	0.009195	0.147133	0.009195	3.77	2E-04
Comprehensiveness	0.002599	0.006855	0.01471	0.006855	0.38	0.705
Family-centeredness	0.038601	0.008579	0.184295	0.008579	4.5	<.0001
Community orientation	-0.02645	0.007441	-0.110634	0.007441	-3.56	4E-04

Ps1. Multiple linear regression was used. Ps2. R^2=0.3405, adjusted R^2= 0.3357

The association between PCAT quality and satisfaction for patients without chronic disease is presented in Table 20. Under unadjusted sociodemographic conditions, all domains were positively associated with satisfaction. Under adjusted sociodemographic conditions, all domains except first contact-accessibility, coordination-referral and comprehensiveness remained significantly positively associated with satisfaction ($p<0.05$, $t>2.01$).

Table 20. Association between PCAT quality and satisfaction for patients without chronic disease

	Unstandardized coefficients		Standardized coefficients		t	P
	B	S.E.	B	S.E.		
Unadjusted						
First contact-utilization	0.080981	0.0081455	0.23753	0.008145	9.94	<.0001
First contact-accessibility	0.031637	0.0036736	0.207225	0.003674	8.61	<.0001
Ongoing care	0.057276	0.0035389	0.369849	0.003539	16.18	<.0001
Coordination-referral	0.069474	0.0060084	0.273554	0.006008	11.56	<.0001
Comprehensiveness	0.043546	0.0038912	0.265379	0.003891	11.19	<.0001
Family-centeredness	0.06247	0.0050303	0.292127	0.00503	12.42	<.0001
Community orientation	0.0493	0.0054237	0.218183	0.005424	9.09	<.0001
Adjusted						
First contact-utilization	0.029772	0.008655	0.087325	0.008655	3.44	6E-04
First contact-accessibility	0.004401	0.003913	0.028826	0.003913	1.12	0.261
Ongoing care	0.036489	0.0047	0.235624	0.0047	7.76	<.0001
Coordination-referral	0.009584	0.007485	0.037736	0.007485	1.28	0.201
Comprehensiveness	0.00332	0.005028	0.020233	0.005028	0.66	0.509
Family-centeredness	0.017298	0.006766	0.080888	0.006766	2.56	0.011
Community orientation	0.012554	0.006252	0.05556	0.006252	2.01	0.045

Ps1. Multiple linear regression was used in the adjusted model with R^2=0.1653 and adjusted R^2= 0.1618

4.7 Association between PCAT Quality and Clinical Outcomes for Patients with Chronic Disease

Hypothesis 6 (H6) states that better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better patient disease-specific clinical outcomes. Clinical outcomes for HbA1C, blood pressure, and LDL-C were assessed. Under unadjusted and adjusted conditions, high HbA1C (>=8) was not significantly associated with any PCAT domains (see Table 21).

Table 21. Association between PCAT quality and high HbA1c (>=8) for patients with chronic disease

	Unadjusted				Adjusted			
	OR	95% CI		P	OR	95% CI		P
First contact-utilization	0.970	0.743	1.267	0.824	1.027	0.744	1.418	0.8715
First contact-accessibility	1.035	0.916	1.170	0.578	1.117	0.966	1.293	0.1358
Ongoing care	0.925	0.825	1.038	0.185	0.885	0.750	1.044	0.1462
Coordination-referral	0.920	0.770	1.100	0.363	0.984	0.768	1.261	0.8968
Comprehensiveness	0.908	0.796	1.035	0.149	0.891	0.736	1.079	0.2387
Family-centeredness	0.979	0.837	1.144	0.788	1.189	0.930	1.520	0.1674
Community orientation	0.903	0.754	1.081	0.267	0.902	0.728	1.119	0.3495

In abbreviation: OR, odds ratio;
CI, confidence interval

Under unadjusted conditions, high blood pressure (>=140/90 mmHg) was not associated with any PCAT domains (see Table 22). Under adjusted conditions, however, it was borderline associated with coordination-referral (p=.0757).

Table 22. Association between PCAT quality and high blood pressure (>=140/90 mmHg) for patients with chronic disease

	Unadjusted				Adjusted			
	OR	95% CI		P	OR	95% CI		P
First contact-utilization	1.024	0.777	1.349	0.8662	0.967	0.687	1.362	0.8489
First contact-accessibility	1.029	0.907	1.167	0.6623	1.051	0.898	1.231	0.5366
Ongoing care	1.016	0.906	1.14	0.7816	0.942	0.780	1.137	0.5310
Coordination-referral	1.139	0.945	1.372	0.1709	85	0.974	1.695	0.0757
Comprehensiveness	0.983	0.861	1.122	0.7968	0.887	0.723	1.089	0.2523
Family-centeredness	1.047	0.894	1.226	0.5717	1.093	0.839	1.424	0.5117
Community orientation	0.961	0.804	1.148	0.6593	0.911	0.730	1.137	0.4092

In abbreviation: OR, odds ratio; CI, confidence interval

Under unadjusted conditions, high LDL-C (≥100 mg/dL) was associated with first contact-utilization, ongoing care and community orientation (see Table 23). Under adjusted conditions, however, only community orientation maintained an association.

Table 23. Association between PCAT quality and high LDL (>=100 mg/dL) for patients with chronic disease

	Unadjusted				Adjusted			
	OR	95% CI		P	OR	95% CI		P
First contact-utilization	0.860	0.747	0.989	0.0345	0.892	0.747	1.066	0.2085
First contact-accessibility	0.957	0.898	1.020	0.1787	1.012	0.935	1.094	0.7726
Ongoing care	0.939	0.888	0.993	0.0269	0.947	0.865	1.037	0.2392
Coordination-referral	0.928	0.849	1.015	0.1021	0.977	0.854	1.119	0.7409
Comprehensiveness	0.955	0.893	1.021	0.1761	1.016	0.919	1.123	0.7606
Family-centeredness	0.957	0.884	1.038	0.2888	1.077	0.949	1.221	0.2508
Community orientation	0.907	0.828	0.994	0.0358	0.901	0.809	1.005	0.0609

In abbreviation: OR, odds ratio; CI, confidence interval

CHAPTER 5. DISCUSSION

Many countries are facing the growing burden of chronic diseases and use of secondary (specialty) care over primary care by patients with multi-morbidities. Developing a strong and equitable primary care system is an urgent need. Age, gender, education level, lack of medical insurance, and unhealthy lifestyle factors are prominent predictors of chronic diseases (Wang, 2014). A primary care system can be defined as a multidimensional system that contributes to overall health system performance and health especially for the chronically ill. It includes structure, processes, and outcomes that can be determined by several core dimensions (Kringos, 2010).

The conceptual framework used for this study was based on Donabedian's classic model of "structure," "process," and "outcome" for the assessment of care quality. An effective measurement index focuses on patients, families, and communities. In a study on medical physicians using the PCAT provider version, GPs reported a higher quality of primary care than other physicians and were more likely to prefer staying in their current jobs. GPs provide more comprehensive care and community orientation, and residents can access basic medical care and better quality health care services through them instead of through crowded secondary or tertiary health care institutions (Zou, 2015).

Because the PCAT was designed to assess both structural and process features of primary care, it is available in multiple user formats (Malouin, 2009). The Chinese version of the PCAT used in Taiwan contains seven core domains: first contact (utilization), first contact (accessibility), longitudinal/ongoing care, coordination, comprehensiveness (services provided), family-centeredness and community orientation. The validity and reliability of the PCAT-C was confirmed. The domain of comprehensiveness (service available) was dropped in accordance with the original Chinese version because they are the regular health care services provided by CHCs (Yang, 2013). As the original PCAT questionnaire is quite long, a short form questionnaire was developed. Evidence of validity and reliability was checked and it can be used as a measure of primary care experience if the space is at a premium such as in the case of population health surveys (Berra, 2011). In another assessment tool known as the Chinese Rapid Primary Care Assessment Tool (CR-PCAT), comprehensiveness (service available) was also dropped (Mei, 2016). Because much information was lost with the omission, many researchers would like to include this domain in research (Bresick, 2015). In Haiti, 91% of the population lives within 5 km of a primary care facility, but only 23% of the population, including just 5% of the rural population, has access to primary care of good quality (Gage, 2017). The primary care service afforded first visit in the community would be quite helpful for improving first-contact utilization and coordination of primary care. Other

domains, however, such as ongoing care and comprehensiveness, are lacking. This is an important issue faced by medical care systems (Liang, 2019).

This thesis utilized the PCAT-C via two study aims and six research hypotheses. The first study aim was to validate the Chinese edition of Primary Care Assessment Tool (PCAT-C) for use in Taiwan. The first study aim contained two research hypotheses: H1: The PCAT-C is valid for the rural Taiwanese offshore island patient population. H2: The PCAT-C is valid for the rural Taiwanese offshore island chronically ill patient population.

The second study aim was to examine the association between domains of primary care quality and patient outcomes, and was discussed via four hypotheses: H3: Better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better patient-reported health status. H4: Better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with selected patient-level socioeconomic characteristics such as education, income, and living places. H5: Better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better patient satisfaction with their primary care experience. H6: Better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better

patient disease-specific clinical outcomes. Results of hypothesis testing are summarized below.

5.1 Study Results

The sociodemographic characteristics of participants were analyzed in Table 3. There were 2,913 participants with a participation rate of 34.65% in the population above 30 years of age. The gender percentages of females and males were 51.13% and 48.87%, respectively. The percentage of patients with chronic disease was 35.50% (1,034/2,913). Patients with lower education levels (lower than high school) and lower household incomes (lower than 1,999 USD) had higher rates of chronic disease (p=.0001 and p=.0045, respectively).

Because of differing levels of health care resources, there were significant differences in primary care quality among residents of different islands. This included access, ongoing care, coordination, comprehensiveness, and community orientation (Table 15). There were more medical resources in Nangang, and the difference in PCAT measurement was significant with other islands, especially for first contact (accessibility) and ongoing care. A high scale in Juguang may have resulted from the smaller population and lower medical demand. There is still much room for improvement in service quality to guarantee not only the presence of but also the wide extension of primary health care attributes (Rolim,2019). In another rural study,

the use of the PCAT-Brazil as a routine assessment and planning tool seemed improbable in the given setting due to high costs, lack of trained personnel, and a large workload (Ponnet, 2019).

5.1.1 Validity and reliability of the PCAT-C

Construct validity is the degree of a measure's score supporting the inference that it represents. Structural validity is considered one aspect of construct validity, and was performed using confirmatory factor analysis (CFA) (Polit, 2015). Seven factors were listed and analyzed according to the seven domains of the PCAT questionnaire. If the PCAT was used in cross culture, the domains should be rechecked to increase or decrease the items (Bresick, 2015). Another version of the rapid assessment tool of primary care was also developed and was validated (Mei, 2016).

The validity of the PCAT-C was verified through internal consistency. There are three methods of internal consistency: group contrast, association, and correlation of each item and total scale. The validity of the PCAT was confirmed with both the overall sample and the sub-sample of those with chronic illness.

5.1.2 Association between health status and primary care quality

After adjustment, significant differences existed between the primary care quality measurements for patients with and without chronic disease (p= 0.0487) (Table 9). The most significant differences were in utilization, accessibility, coordination, and comprehensiveness. For those with chronic disease, first contact, coordination, and comprehensiveness were most important for long-term care convenience. For those without chronic disease, the information getting from community orientation activity may become important but there were no statistically significant differences. More patients should be encouraged to participate in health literacy activities in the community hereafter. These findings differ from other research that found < 50% scored 'acceptable to good' in the areas of first contact (accessibility), ongoing care and community orientation (Bresick, 2019). This may be due to differing levels of medical resources in different countries.

Because people younger than 49 years of age received less health services, no difference existed in their health service quality test. Being over 50 years of age was associated with higher rates of chronic disease and quality.

There were no associations between socioeconomic factors and primary care quality except for age ($p<0.0001$), but age was not significantly associated after adjustment ($p=0.2764$) (Table 6). In a separate analysis, there was also no association found between primary care quality and socioeconomic factors.

5.1.3 Association between patient satisfaction and primary care quality

The PCAT is associated with patient psychological reactions to primary care services. Especially for patients with chronic disease under adjusted conditions by age, education level, household income, and job status, all domains except community orientation were positively associated with satisfaction. For patients without chronic disease under adjusted sociodemographic conditions, all domains except first contact-accessibility and comprehensiveness remained positively associated with satisfaction. The PCAT results may show differences between provider and user perceptions of PHC performance. In addition to PHC team performance, it should encourage and support CHC and medical service providers at the district level in their efforts to improve the quality and user experience of primary care (Mukiapini, 2018). In some cases, family physicians were associated with better indicators of performance and processes in local hospitals but not in community health centers (Pressentin, 2018).

5.1.4 Association between patient clinical outcomes and primary care quality

The PCAT revealed that primary care quality is not associated with clinical outcomes. High HbA1c (>=8) was not associated with any PCAT items. Under adjusted conditions, all PCAT items except coordination-referral were not associated with high blood

pressure (>=140/90 mmHg), revealing that more needs to be done in improving patient care and care management for those with high blood pressure.

Under unadjusted conditions, LDL-C ≥100 mg/dL was associated with first contact-utilization, ongoing care and community orientation. But after adjustment, only community orientation was associated with LDL-C ≥100 mg/dL. PCQ does not seem to be associated with hyperlipidemia without clinical symptoms and signs. Patients prefer further follow-up in the community. Although technical advances in medicine are important, increased continuity of medical care is associated with lower mortality rates (Gray, 2018).

5.2 Contributions to Literature

This section summarizes contribution of current study to the scientific literature regarding PCAT (Study Aim 1) and the contribution of primary care.

5.2.1 Contribution towards PCAT

Our validation analysis (Study Aim 1) shows that all the seven domains of primary care captured in PCAT-C are retained. Thus, the PCAT Taiwan Edition (PCAT-T) is a valid and reliable tool that measures the patients' experience of primary care.

Our validation effort contributes to the further development and popularization of PCAT as an effective patient self-reported tool. Consistent with previous validation effort such as in the USA (Shi et al., 2001a, Shi et al., 2001b), Brazil (Harzheim et al., 2006), Spain (Rocha et al., 2012), and China (Yang, 2013). The validated shortened PCAT questionnaire now includes 43 items covering regular source of care, utilization patterns, and the quality of that primary care experience (i.e., first contact, longitudinal/ongoing care, coordination, comprehensiveness (services provided), family centeredness, and community orientation. An additional 23 items are used to assess patient-level covariates.

Our validation experience shows that most PCAT domains are universal and can be applied in different cultural background and under different health care systems. Some domains, especially services available and provided, could vary by location due to varying prominent health problems faced by the country and varying capacity at the primary care level. For those domains, so local adjustment could be necessary. As health problems evolve and skill capacity enhance, the contents of the domains may be updated likewise.

Besides in the United States, the PCAT has also been tested and used in multiple other countries around the world, including Canada, China, Japan, South Korea, Vietnam, Brazil, Argentina, South Africa, and Malawi (D'Avila et al., 2017; Mei et al., 2016; Hoa et al., 2018; Bresick et al., 2015 and 2019; Dullie et al., 2018). In all instances, the PCAT was able to be

modified and adapted to each respective cultural context. In agreement with previous cross-cultural studies, this study found the PCAT able to be reliably and validly adapted to assess the Taiwanese primary care system. PCAT's ability to demonstrate reliability and validity across multiple countries and healthcare organizational structures makes it a prime candidate for being a uniform method of primary care quality assessment. As mentioned in the introductory chapter, updating the PCAT so that its components remain relevant to the ever changing and evolving field of healthcare is essential to ensuring that it remains a valid and comprehensive instrument for measuring primary care quality.

5.2.2 Primary care and equity

Study Aim 2 examines the associations between domains of primary care quality and patient outcomes. Two critical indicators used examine primary care and equity concerns among subpopulations. The first indicator used is whether patients had chronic illness or not. The analysis shows that those with chronic illness performed better than those without in all the primary care domains (H3). The second indicator examines whether primary care quality varies by patients with different socioeconomic status. Results of the study demonstrate that primary care overcomes the gaps between those better-educated and those poorly-educated,

between those of high-income and those of low-income, but good primary care experience hinges on its adequate supply (H4).

Our study results are consistent with the bulk of research examining primary care and equity. Research shows that primary care is also associated with more equitable distribution of health within a population (Starfield, Shi, and Macinko 2005; Starfield et al, 2005; Shi, et. al., 2005a; Shi, et. al., 2005b). The annual National Healthcare Disparities Report in the USA (Agency for Healthcare Research and Quality 2008) stated that equitable primary care eliminates disparities "related to preventive services and management of common chronic diseases typically delivered in primary care settings" (Siegel et. al. 2004). Primary care providers deliver a disproportionate share of ambulatory care to disadvantaged populations. Improved access to primary care was associated with reduced mortality rates, better health outcomes, and lower costs (Franks and Fiscella 1998; Campbell et al. 2003; Shi et al. 2003a; Shi et al. 2003b; Shi et al. 2003c). Research has also shown that primary care may play an important role in mitigating the adverse health effects of income inequality (Shi et al. 1999; Shi et al. 2000; Shi et al. 2002; Shi et al. 2001). Therefore, the pathway through which income inequality impacts health may be partly attenuated by primary care (Shi et al. 2002). Access to quality primary care may have the largest impact on health in areas with the highest levels of income inequality (Shi et al. 2002). However, socioeconomic status may also reduce to some

extent the impact of primary care on health (Shi et al. 2002). Primary care availability may also be more strongly correlated with health outcomes in areas with greater levels of income inequality, suggesting that expanding primary care availability in these areas may have a substantial impact on population health (Shi et al. 1999). Our study added further evidence of the primary care – equity link by removing barriers for the most vulnerable, i.e., those with chronic illness and those of low-income.

5.2.3 Primary care and satisfaction

Our study further examines whether primary care quality contributes to patients' satisfaction level. The analysis shows significant associations between PCAT quality and satisfaction (H5). This finding demonstrates that patient evaluations of the quality of care they receive in primary care settings can be appropriate complements to other measures of quality (Bower 2003). Patient assessments may be particularly useful for evaluating satisfaction with access, the practitioner-patient relationship, continuity, and coordination (Bower 2003). However, patient satisfaction with the care experience may not be equated with good outcome without further evidence. For example, a study found that patient-reported satisfaction with quality of care among the elderly was not a good predictor of the effectiveness of the care these patients

received (Mold et al. 2011). However, satisfaction with coordination of care did have a relationship with survival time among the higher utilizers (Mold et al. 2011).

5.2.4 Primary care and clinical outcomes

Finally, on the relationship between primary care quality and disease-specific clinical outcomes (H6), the analysis yields mixed findings: for high LDL-C (≥100 mg/dL), good primary care is associated with better LDL-C performance; for high blood pressure (>=140/90 mmHg), high blood pressure control is only borderline-associated with the coordination-referral dimension of primary care; and for high HbA1C (>=8), good HbA1C performance was not significantly associated with any PCAT domains.

These findings are consistent with research conducted in the past few decades, providing further evidence for the association between primary care quality and experience with patient outcomes. Yassaee et al. (2017) conducted a study in England that found poor adolescent patient experience was significantly associated with worse health measures. Another study conducted by Li et al. (2018) found that patients in Guangzhou, China with contracted general practitioners (GP) tended to have overall higher quality experiences with primary care and specifically with regard to continuity, comprehensiveness, and family-centeredness. A U.S. study conducted by Cedillo-Couvert et al. (2018) found an association between lower

perceived primary care experience among Hispanic chronic kidney disease patients and a higher risk of hospitalization. This association was also seen among Ghanaian primary care patients, providing further evidence that the trend applies across diverse country and cultural contexts (Ofei-Dodoo, 2019).

One component of quality, continuity, has been linked multiple times to better outcomes in the forms of lower patient mortality, lower expenditures, and lower hospitalization rates (Pereira Gray et al., 2018; Bazemore et al., 2018). More broadly speaking, adults who have a primary care source were found to receive higher value care and have better healthcare experiences overall (Levine et al., 2019). The regularity with which patients visit a primary care provider was also positively associated with better health outcomes, including fewer emergency department visits and hospitalizations (Rose et al., 2019). Lower quality care may also lead to lower rates of utilization, discouraging people from seeking out treatment and further increasing the risk of poor health (Gage et al., 2018). Although not all recent studies agree on primary care's positive impact (i.e. von Pressentin et al., 2018), evidence still overwhelmingly continues to validate previous findings, highlighting the significance of primary care quality in improving patient outcomes.

5.3 Limitations

The following limitations must be considered when interpreting the study results:

5.3.1 Selection bias: This was a visit-based survey instead of a person-based survey; therefore, sampling was not random. All participation was voluntary and subjects received notification by postcard and phone call; therefore, individuals who were not concerned with their health and those who did not receive notification did not take part.

5.3.2 Cross-sectional study: The questionnaires were answered only once and reported cross-sectional associations.

5.3.3 Recall bias: Throughout treatment, many individuals received medical care from different physicians, which could have led to reporting error and recall bias that was not accounted for in the statistical adjustments. Furthermore, participants responded based on their subjective assessments of previous experiences rather than through the use of objective measurements of primary care quality.

5.3.4 Medical density: The study took place on the offshore islands of Taiwan. Environmental and lifestyle variations among the residents may compromise the representativeness and generalizability of this study. The medical density in Lienjiang county also differs from that observed in the rest of the country. According to the Ministry of Health and Welfare, the density of ambulatory care physicians in Lienjiang county in 2014 was 14.39/10,000 inhabitants, which is slightly lower than the 18.44/10,000 for Taiwan overall.

5.3.5 Confounding factors: There were no doubt a number of unadjusted confounding variables, such as income inequity, that influenced self-reported health status and may require further study.

5.3.6 Missing data: Many patient questionnaires were incomplete, and the results were analyzed by excluding missing data.

5.4 Strengths

This study had the following strengths:

***5.4.1 Sample size*:** These islands represent a nearly closed community with a very small population; therefore, we can expect that patient experiences of medical care were highly representative of the overall population.

5.4.2 High sampling rate: Questionnaires were administered on site of annual health examinations and the sampling rate exceeded 30% of all residents >30 years and older. The research workers were well trained with experience in administering questionnaires; therefore, we have confidence in the quality of the results.

5.4.3 Closed system: The offshore islands have a stable population. Residents receive medical care locally and have low recall bias that might otherwise be complicated by other medical

care experiences. Health care providers seldom change; therefore, these forms of related interference should have been negligible.

5.4.4 Health insurance system: The single health care system ensures consistent health care throughout the country, including the certification of health care personnel, the health care payment system, and the adjustment of health insurance premiums.

5.5 Future Research

The development of primary care measurement instruments such as the PCAT reflects the growing interest in understanding how primary care performance can be improved. International studies using the PCAT have identified specific domains that seem to show low performance across multiple countries. First contact-access, comprehensiveness, family orientation, and community orientation have elicited poorer scores in comparison to other domains (15.78%, 28.57%, 13.33%, and 11.11% of studies showing good performance, respectively) (Prates et al., 2017). These domains represent areas in which strategies can be developed to improve primary care quality.

Not all performance improvement efforts, however, are created equal. Hung et al. (2019) found that certain contextual factors of primary care clinics tend to be associated with better performance improvement. These include having prior experience with quality improvement,

higher levels of work stress, staff participation, leadership support, and teamwork. Keeping these factors in mind will help create performance improvement plans that are more tailored to and mindful of any barriers and facilitators involved. Future research can help evaluate the multiple interventions and strategies around the world aimed at improving primary care performance.

Outside of the PCAT domains, many other components of primary care also represent areas for improvement. One that has garnered significant attention in recent years is equity. Many individuals experience financial and social barriers that make it difficult for them to receive the care they need. Certain aspects of lifestyle and behavior, along with issues pertaining to access to nutritional food and community safety, also put marginalized groups at higher risk for poorer health. As the gatekeeper to the health care system, primary care serves an important role in providing access to care, the equity of which has empirically been shown to improve health outcomes for marginalized populations. For example, a study on equity-oriented healthcare (EOHC) found that higher levels of EOHC led to greater patient comfort, confidence in managing conditions, and improved health outcomes (Ford-Gilboe et al., 2018). In contrast, non-equitable care experiences involving financial strain and discrimination had the opposite effect. Such evidence supports the restructuring of primary care systems in a way that addresses inequities in access and the experience of care.

Recent studies have identified specific areas that can be improved to reduce these disparities. A study by Zhong et al. (2018) conducted in Guangdong, China found that although equity between rural-to-urban migrants and urban locals had been achieved to some extent, improvements in care coordination and comprehensiveness could still be made. A study on primary care equity for "sicker adults" in ten different OECD countries similarly uncovered specific areas in which countries could improve. For the United States in particular, low-income patients were more likely to rate access to care, coordination, patient-centered care, and technical quality of care as poorer across the board compared to high- and middle-income individuals (Dahrouge et al., 2018). In all countries surveyed, inequities in quality of care existed between income groups. These findings provide further evidence for the need to focus on equity in improving primary care performance and identify areas in which changes can be made. More studies are needed to further explore how primary care might mitigate the adverse effect of inequity on health care and outcome.

Another issue with primary care performance is the discrepancy between provider and user perceptions of the quality of care delivered. A study conducted by Mukiapini et al. (2018) in a primary care facility in Cape Town, South Africa found that 64% of users rated overall primary care performance as acceptable to good, while 75% of providers rated it the same way. Another South African study by Bresick et al. (2019) similarly found that providers

seemed to be more optimistic about the quality of care they delivered compared to actual patient experiences with that care. Although both of these studies took place in South Africa, the implications can be considered for primary care systems around the world. Indeed, in their Taiwanese study, Shi et al. (2012) acknowledge that their data may indicate differences in patient and provider perceptions of primary health care performance. Providers, who come from a medical background perspective and are more aware of the actual processes and limitations involved in the delivery of care, may be less attuned to how patients on the receiving end actually perceive that care. This issue provides an area of focus where improvements can be made so that patients and providers are in better alignment with regard to their perceptions of primary care quality. More research on provider-patient interactions is needed to further demonstrate the concordance of perceptions by providers and patients.

A third area of improvement for primary care performance pertains to its integration with other healthcare services and within a community context. Of particular interest has been the integration of psychiatric and behavioral health services with primary care. Multiple studies have assessed the value of primary care integration with behavioral health and found significant benefits in terms of health outcomes. Patients who received care under such integrated models were significantly more likely to achieve care plan goals, show reductions in depression severity, and have better experiences with care (McGough et al., 2016;

Balasubramanian et al., 2017). Additionally, the value of integrating care within a community context has also been widely corroborated. A study conducted by Kangovi et al. (2018), for example, found that incorporating community health workers into the primary care delivered in various settings improved patient-perceived quality of care and reduced hospitalizations. Yet community health workers, who support integration through a wide range of roles including health coaching, social support, and literacy support, are still widely underutilized in the delivery of care, highlighting room for improvement (Hartzler et al., 2018). Given the extensively demonstrated benefits of integration, more work can be done to implement such models to boost primary care performance and more research should follow to assess these models. The relationship of quality of primary healthcare and length of hospitalization and rate of emergency visits could be researched in the future.

5.6 Human Subjects

This study involved the assessment of primary care, including clinical care and public health intervention, in Lienjiang County, Taiwan. The researchers recruited volunteers between January 1st, 2017 and July 31st, 2017. The questionnaire was administered in 2017 and the physiological clinical outcomes analyzed were retrograded from 2016 to 2017. A total of

12,524 residents in this county are served by community health centers and a local public hospital.

The National Healthcare Insurance (NHI) system was established in Taiwan in 1995. Approximately 99.6% of all residents are currently covered. Insurance coverage is comprehensive and almost all medical services are covered, including inpatient, outpatient, dental services, traditional Chinese medicine, neonatal delivery, preventive vaccination and nearly 20,000 prescription medicines. This is a single-payer program; therefore, the NHI offers no choice as to the carrier and offers unlimited freedom of choice in the selection of medical care providers with more than 25,000 contracted facilities from which to choose. Even individuals living in remote areas and on offshore islands can obtain primary care and specialty care through the integrated delivery system (IDS) of the NHI.

The total population of Lienjiang County is 12,524 spread out among four islands: Nangan (7,463), Beigan (2,316), Juguang (1,488), and Dongyin (1,268). There is a local hospital in Nangan and a health center on each of the islands. In 2017, there were 2,873 adult residents, 34.2% of whom were over 30 years of age and received annual integrated community-based screening services. This project offered the benefit of understanding the quality of primary care and improving it through evaluating the dynamics of the health outcomes of inhabitants. Informed consent was received before completion of the

questionnaire, which included the introduction of the questionnaire and consent to analyze their health records. Participants had the right to refuse taking the questionnaire and could withdraw from the study at any time. As no clinical procedures were involved, there was no invasive risk to the subjects. The law also mandates the confidentiality of their health records. Investigators applied the institutional review board (IRB) of Johns Hopkins University and National Taiwan University if needed, as the school has a corporation of research with Health Bureau of Lienjiang County. Blood specimens were discarded after examination and were not used for other purposes. Because clinical invasion was not necessary, privacy was protected, and residents had the chance to improve the quality of primary care they received and protect their right to health, the benefits prominently outweighed the risks. A separate study found that equity in primary care patient experiences between rural-to-urban migrants and urban locals seemed to have been achieved to some extent. In Taiwan, all residents, including rural and urban residents, are covered by NHI. Differences in coordination and comprehensiveness of care between rural and urban residents should be examined in more depth (Zhong, 2018).

5.7 Conclusion

5.7.1 Summary of results

Study Aim 1 calls for the validation of the Primary Care Assessment Tool (PCAT) in Taiwan based on the previously validated Primary Care Assessment Tool – Chinese Edition

(PCAT-C). Specifically, Hypothesis 1 (H1) states that the PCAT-C is valid for the rural Taiwanese patient population of offshore islands. Our validation analysis shows that all the seven domains of primary care captured in PCAT-C are retained. Factor loadings for the dimensions ranged from 0.3841 to 0.8447. Community orientation had the most focused and highest factor loadings (0.7438 to 0.8447), while comprehensiveness (service provided) had the most disparate and lowest factor loadings (0.3841 to 0.7718). Hypothesis 2 (H2) states that the PCAT-C is valid for the rural Taiwanese chronically ill patient population of offshore islands. Similar confirmatory factor analysis was also performed using patients with chronic conditions only and resulted in similar findings. In sum, the PCAT is a valid, reliable and responsible tool with psychometric properties in the multidimensional quantification of primary health care, similar to previous PCAT-related validation efforts.

Study Aim 2 examines the associations between domains of primary care quality and patient outcomes. Specifically, Hypothesis 3 (H3) states that better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better patient-reported health status. Patient-reported health status focuses on those with chronic illness such as hypertension, diabetes, hyperlipidemia or not. The analysis shows that

those with chronic illness performed better than those without in all the primary care domains.

Hypothesis 4 (H4) states that better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with selected patient-level socioeconomic characteristics such as education, income, and living places. For education, the analysis demonstrates that those with lower level of education experienced better primary care quality in all the individual domains. With regard to income, those with lower household income experienced better primary care quality in all the individual domains except ongoing care, comprehensiveness, and community orientation where the differences were not statistically significant. In terms of living places, patients living in areas with better primary care resources also experience better primary care quality than those living in areas with poorer primary care resources. These analyses indicate that primary care overcomes the gaps between those better-educated and those poorly-education, between those of high-income and those of low-income, but good primary care experience hinges on it adequate supply.

Hypothesis 5 (H5) states that better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better patient satisfaction with the experience of care. Our analysis focused on patients with chronic

diseases such as hypertension, diabetes, and hyperlipidemia. The results show significant association between PCAT quality and satisfaction. Under unadjusted sociodemographic conditions, all domains were positively associated with satisfaction. Under adjusted sociodemographic conditions, all domains except first contact-accessibility and comprehensiveness remained significantly positively associated with satisfaction.

Hypothesis 6 (H6) states that better scores on the PCAT-C domains of first contact, longitudinality, coordination, etc. will be significantly associated with better patient disease-specific clinical outcomes. Clinical outcomes for HbA1C, blood pressure, and LDL-C were assessed. Under unadjusted and adjusted conditions, high HbA1C (>=8) was not significantly associated with any PCAT domains. Under unadjusted conditions, high blood pressure (>=140/90 mmHg) was not associated with any PCAT domains (see Table 22). Under adjusted conditions, however, it was borderline associated with coordination-referral (p=.0757). Under unadjusted conditions, high LDL-C (≥100 mg/dL) was associated with first contact-utilization, ongoing care and community orientation (see Table 23). Under adjusted conditions, however, only community orientation maintained an association.

5.7.2 Final remarks

In 2018, world leaders convened at the Global Conference in Astana hosted by the WHO and UNICEF to reaffirm their commitment to primary healthcare. Through the Declaration of Astana, that pledges were made in four key areas:

1) "Make bold political choices for health across all sectors;
2) Build sustainable primary healthcare;
3) Empower individuals and communities; and
4) Align stakeholder support to national policies, strategies and plans." (WHO, 2018)

This new declaration underscores the continuing global recognition of the need to support primary care systems worldwide. The Primary Care Assessment Tool (PCAT) provides an excellent method for assessing and identifying ways in which primary care systems can be improved; as such, it is important to ensure that the instrument stays updated and malleable to change as the field of health care evolves. Key considerations, including equity and patient-provider alignment, represent areas in which primary care performance can be improved. As research continues to uncover consistencies as well as discrepancies regarding the impact of primary care, approaches to its assessment and implementation can be refined.

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Appendix 1: Result of expert review and pilot test of the Primary Care Assessment Tool—English

Item codes	Original questionnaire	Final questionnaire
	Identify primary care provider (PCP)	
A1	A doctor/place you usually go when you get sick or for health advice?	
A2	Who is the doctor/where is the place that knows you best as a person?	
A3	Who is the doctor/where is the place most responsible for your health care?	Removed
	First contact (utilization)	
B1	Do you have regular checkups by a PCP before going somewhere else?	
B2	Do you see a doctor for new health problems before going somewhere else?	
B3	Does your PCP approve or give referrals for specialist service?	Removed
	First contact (access)	
C1	Is the PCP's clinic open on Saturday or Sunday?	Removed
C2	Is the PCP's clinic open on some weekday evenings until 8 pm?	Removed
C3	Does your PCP see you on the same day?	
C4	Do you get advice over the phone when your PCP's clinic is open?	
C5	Do you get advice over the phone when your PCP's clinic is closed?	
C6	Does your PCP see you on the same day when the PCP is closed on weekends?	Does your PCP see you on the same day when you get sick and your PCP's clinic is closed?
C7	Does your PCP see you at night when you are sick and the PCP's clinic is closed?	
C8	Is it easy to get an appointment for a general checkup?	Removed
C9	Is your waiting time >30 min?	

C10	Does it take a long time for you to get an appointment?	Removed
C11	Is it difficult for you to get medical care from your PCP when it is need?	
C12	Do you take off from work or school to go to your PCP?	Removed
	Ongoing care	
D1	Are you taken care of by the same doctor/nurse in PCP?	
D2	Does your PCP understand what you say or ask?	Removed
D3	Are your questions answered in ways that you understand?	
D4	Do you talk to the doctor/nurse who knows you best if you have questions?	
D5	Does your PCP give you enough time to talk?	Does your PCP give you enough time and make you feel
D6	Do you feel comfortable telling your PCP your worries/concerns?	comfortable talking about your concerns? (in Chinese).
D7	Does your PCP know you well as a person (not just as somebody with a medical problem)?	Removed
D8	Does your PCP know who lives with you?	Removed
D9	Does your PCP know what problems are most important to you?	Removed
D10	Does your PCP know your complete medical history?	Removed
D11	Does your PCP know about your work or employment?	Removed
D12	Does your PCP know if you have trouble paying for your medicine?	
D13	Does your PCP know all the medications you are taking?	
D14	Could you change your PCP if you wanted to?	Could you change your PCP if needed?
D15	Would you change your PCP if it was easy to do so?	
D16	New	Do you follow-up with treatment and taking medicine?
	Coordination	
E1	Do you get lab results?	Removed

E6	Does your PCP suggest for you to go to specialists/ special services?	Removed
E7	Does your PCP know you made visits to specialists/ special services?	Removed
E8	Does your PCP discuss the different places you can go for your health problems?	Does your PCP discuss the different places, recommend a better place and explain the reasons?
E9	Does your PCP make the specialist visit appointment for you?	Removed
E10	Does your PCP write down information about the reason of your visit?	
E11	Does your PCP know the results of your visit?	Does your PCP talk with you
E12	Does your PCP talk with you about what happens at the visit?	about what happens at the visit and know the result of your visit?
E13	Is your PCP interested in the quality of care of your specialist/special service?	Removed
E14	New	Does your PCP help with registration and set up a special channel to see a specialist or seek special services?
F1	Do you bring your medical record with you to your PCP?	Removed
F2	Do you have access to your medical record if you wanted to?	Removed
F3	Is your medical record always available with your PCP?	Removed
	Comprehensiveness (services available)	**Removed**
	Comprehensiveness (services provided)	
H1	Does your PCP give you advice about diet and sleep?	
H2	Does your PCP give you advice about home safety, like storing medicine?	Does your PCP give you gun safety or advice about home safety, like getting air circulation or in storing medicine?
H3	Do you have stress consultations?	Do you have consultations about pressure at work and interpersonal conflicts?
H4	Does your PCP give you advice about handling family	

		conflicts?	
	H5	Does your PCP give you advice about exercise?	
	H6	Do you have tests for your cholesterol level?	
H6a	H6a	New	Do you have your blood pressure checked?
	H7	Do you check on medications?	Remove
	H14	Do you have feminine care for menstrual/menopause problems?	Do you receive a regular feminine check-up?
		Family-centeredness	
	I1	Does your PCP ask about your ideas about planning treatment for you or your family members?	
	I2	New	Does your PCP introduce to you and your family the types of medicines you could possibly get and ask about your ideas before giving a prescription?
	I3	Does your PCP ask about illnesses or problems that might run in your family?	
	I4	Does your PCP meet with members of your family if needed?	
		Community orientation	
	J1	Does your PCP ever make home visits?	
	J2	Does your PCP know about important health problems in your neighborhood?	
	J3	Does your PCP get opinions from people with better knowledge on giving care?	
	J11	Does your PCP survey patients to see whether needs were met?	
	J12	Does your PCP survey the community to uncover health problems?	
		Cultural competency	
	K1	Would you recommend your PCP to a friend or relative?	Removed
	K3	Would you recommend your PCP to someone who uses folk medicine?	Removed
		About your PCP	
	A4	Is your PCP a place/doctor/nurse/none of them?	Removed
	A5	What kind of office is your PCP's clinic?	Rewording

A6	Does your PCP take care of adults/children and adults?	Removed
A7	Does your PCP take care of most patients or only those with only certain kinds of problems?	Removed
A8	How many times have you been to your PCP?	How many times in the past year have you been to your PCP?
A9	How long have you been going there?	Removed
A10	Did you choose this PCP or were you assigned to go there?	
A11	Do you go there mainly because of a special medical problem?	Removed
A12	New	Are you satisfied with their service?
A13	New	If satisfied/dissatisfied, why?
A14	New	What is the medical specialty field of your PCP?
	About specialist visit or special service	
E2	Have you ever made a visit to specialist/special service?	Removed
E3	When was the last time you visited a specialist/ special service?	Removed
E4	Was this visit for a condition that has not been cured or has persisted longer than 1 year?	Removed
E5	Had you ever visited that specialist/special service before the last visit?	Removed
E4a	New	In the past two years, how many times have you gone for further treatment or for a more complicated checkup?
L1	How much of the past 12 months were you covered by health insurance?	Removed
L9	In the last year, did you have trouble paying your health care bill?	Removed
L10	Do you have to pay something at each visit to the ER or to the PCP?	Do you have to pay your PCP?
L11	Do you get most of your money back from health	Removed

	Insurance?	
	Health status and awareness	
M1	Self-reported health status	
M2	Any physical, mental or emotional problems lasting or likely to last longer than 1 year?	
M3	New	Do pay you attention to your health?
M4	New	How regularly do you exercise?
M5	New	How do you mainly obtain health information?
	Socioeconomic status	
L2-L8	Methods of paying your health-care bill?	
L8a	New	If you have insurance, are you satisfied with it? If not, why?
N1	Gender	
N2	Age	
N2a	New	If 65 or above, do you have health records?
N3	Zip code	Removed
N4	Ethnicity	Removed
N7	Occupation	Rewording
N7a	Employment status	Rewording
N8	Education	Rewording
N9	Family monthly income	Rewording

Appendix 2: Result of expert review and pilot test of the Primary Care Assessment Tool (PCAT)—Chinese

Item codes	
	Identify primary care provider (PCP)
A1	您身體不舒服或者需要健康諮詢的時候,有沒有一個看病方便的醫療院所或醫生?
A2	您覺得有沒有醫生或醫療院所對您或您家人的基本情況比較了解？
	First contact (utilization)
B1	(去其他地方看病前)您會在該院所作常規檢查,基本治療嗎？
B2	您一生病,首先會去該院所看病嗎？
	First contact (access)
C3	該院所能當天就診嗎？
C4	該院所上班時間可以電話諮詢嗎？
C5	該院所下班時間可以電話諮詢嗎？
C6	該院所下班時間可以當天就診嗎？
C7	您覺得生病時夜間就診方便嗎?
C9	您常等待看病時間超過 30 分鐘嗎？
C11	您覺得想得到所需的醫療服務很困難嗎？
	Ongoing care
D1	每次都是同一位醫生給您看病嗎？
D3	醫師回答您的問題時,容易理解嗎？
D4	有問題或不舒服時,可以找您熟悉的醫生或護士諮詢嗎？
D5	您可以暢所欲言，任何擔心與疑問都有時間說，都有時間問您的醫師嗎？
D12	如果您付醫藥費自付額有困難時,醫師知道嗎？
D13	醫師知道您正在服用的所有藥物嗎？
D15	如果需要的話,您會想去別的醫院看病嗎？
D16	您會追蹤治療和用藥的效果嗎？
	Coordination
E8	醫師會討論並推薦可以給您進一步治療檢查的醫療場所嗎？
E10	醫師會寫下詳細就診治療，以供對方醫院參考嗎？

E11	醫師了解您去對方醫院進行進一步治療檢查後的情況和結果嗎？
E14	醫師會幫您預約掛號，聯繫轉診嗎？
	Comprehensiveness (Services provided)
H1	醫師會建議您保持健康飲食和規律睡眠嗎？
H2	醫師會建議您保持居家衛生，比如通風、藥物備用等問題嗎？
H3	您有因為精神工作壓力和人際衝突而就醫嗎？
H4	醫師會妥善處理家庭關係嗎？
H5	醫師會建議您適當運動嗎？
H6	您有定期檢查膽固醇嗎？
H6a	您有定期測量血壓嗎？
H14	您了解女性或男性的保健常識，而且定期檢查嗎？
	Family-centeredness
I1	針對您個人的治療計劃，醫師會考慮您家庭成員的想法和意見嗎？
I2	開藥時，醫師會向您和家人介紹可供選擇的藥品，最後徵詢您的意見和想法嗎？
I3	醫師會囑咐您家人可能要注意的健康問題嗎？
I4	如覺得需要，醫師會與您的家人見面嗎？
	Community orientation
J1	醫師會家訪了解情況嗎？
J2	醫師清楚您的社區人群面臨的重要健康問題嗎？
J11	醫師會抽樣調查病人了解其服務是否滿足了病人的需求嗎？
J12	醫師會問卷調查所服務社區的健康問題嗎？
	About your PCP
A5	您的醫療提供者是衛生所還是醫院？？
A8	在過去一年裡，您大概去您的基本醫療提供方看過幾次病？
A10	是您自己選擇的還是指定的？
A12	您對他們提供的服務滿意嗎？
A13	如果滿意／不滿意，為什麼？
A14	您主要醫療服務提供者的專科別是哪一科?
	About specialist visit or special service
E4a	過去兩年裡，您總共接受過幾次重大的治療和住院？
	Health status and awareness
M1	您的健康狀況怎麼樣？
M2	您有持續一年以上的身體上，精神上，情緒上的問題嗎？
M3	您平時注意自己的健康嗎？

M4	您平時運動嗎？
M5	您主要從什麼管道獲取健康保健資訊？
	Socioeconomic status
L2-L8	您付醫療帳單的方式如何？
L8a	如果有保險的話，對保險滿意嗎？不滿意的話，為什麼？
L10	您就醫或看急診時，有常自付費用嗎？
N1	性別
N2	年齡
N2a	（65 歲和大於 65 歲的）您在醫療院所有任何病歷紀錄嗎？
N7	工作（職務）
N7a	被僱用狀態
N8	教育程度
N9	家庭月收入
N10	您就醫的交通工具或方式是哪一種？

CURRICULUM VITAE

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