Inter-American
Development Bank

Social Sector
Social Protection and
Health Division

DISCUSSION PAPER

No. IDB-DP-189

Chronic Diseases, Primary Care and Health Systems Performance

Diagnostics, Tools and Interventions

James Macinko
Inês Dourado
Frederico C. Guanais

November, 2011

Chronic Diseases, Primary Care and Health Systems Performance

Diagnostics, Tools and Interventions

James Macinko
Inês Dourado
Frederico C. Guanais

Inter-American Development Bank
2011

Acknowledgements

This document was written by James Macinko, PhD,* Inês Dourado, MD, MPH, PhD,** and Frederico C. Guanais, PhD.*** The authors thank Neil Okey and Geronimo Jimenez for research assistance. All views expressed in the document are the authors' own.

Author Affiliations *New York University, ** Federal University of Bahia (UFBA), ***Inter-American Development Bank

Introduction: The burden of chronic disease in Latin America and the Caribbean is large and growing

The four main chronic non-communicable diseases (NCD) - cardiovascular disease, cancer, chronic lung diseases and diabetes - kill three in five people worldwide. Latin American and Caribbean (LAC) countries currently face the double burden of NCD in addition to the continued burden of reproductive and communicable diseases and child malnutrition and anemia--especially in poor communities. See Exhibit 1. The region's rapid demographic and epidemiological transition has led to high levels of NCDs, particularly cardiovascular disease (CVD), stroke and cancers. See Exhibit 2. Mental health problems such as depression have similarly increased. Chronic diseases are now the leading causes of death and illness in LAC, accounting for 68 percent of deaths and 60 percent of disability-adjusted life years (DALY) in the region. Cardiovascular diseases alone are responsible for 35% of deaths in LAC, while the combination of AIDS, TB and malaria, and all other infectious diseases is responsible for 10% of deaths.[1]

Growing exposure to risk factors in combination with low levels of access to preventive care are increasing unmet health needs. LAC has been experiencing a "nutrition transition" towards less healthy diets.[2] Thirty to sixty percent of the region's population does not achieve the minimum recommended levels of physical activity and obesity is rising rapidly.[3] Inadequate access to high quality health services, including clinical prevention and diagnostic services and difficult access to essential medicines are significant contributing factors to the growing burden of chronic disease. [1]This chronic disease burden is expected to increase due to the aging of the population and to the relative decline in the proportion of communicable diseases. Predictions for the next two decades show a near tripling of diabetic patients, ischemic heart disease and stroke mortality in LAC.[4]

In recognition of these facts, the United Nations General Assembly in recognition of the burden of NCD convened a High-Level Meeting on NCDs on 19-20 September 2011. "The summit in September in New York is our chance to broker an international commitment that puts non-communicable diseases high on the development agenda, where they belong", said Ban Ki-moon-United Nations Secretary-General.

[1]Pan American Health Organization, 2007.
[2] Rivera, J.A., et al., 2004.
[3] Hoehner, C.M., et al., 2008.
[4] Lopez, A.D., C.D. Mathers, and M. Ezzati, 2006.

Although chronic diseases affect all population groups, outcomes are considerably worse for the poor, because of higher prevalence of risk factors, lower access to screening and treatment services[5,6], and lower ability to cope with the financial consequences of chronic diseases.[7]

Inequalities affect both communicable and non-communicable diseases, and are an issue even in the wealthiest countries. NCDs affect the poor disproportionally and this is compounded by lack of access to quality interventions to prevent and manage these conditions.[8]

The economic and fiscal costs of chronic diseases are large and growing. A study of low and middle income countries, which included Brazil, Argentina, Mexico, and Colombia, estimated that US$ 85 billion of economic production will be lost from heart disease, stroke and diabetes between 2006 and 2015 within the 23 nations that were analyzed. [6] The direct costs of diabetes alone in Latin America and the Caribbean have been estimated to be around US$ 10 billion per year.[9] The economic consequences of chronic disease also include the negative impact on consumption and saving, on labor supply and productivity, and on human capital accumulation.[7] Therefore governments will need to strengthen their responses and prioritize interventions based on evidence of cost-effectiveness, financial protection and responsiveness criteria.

A. Chronic disease deaths are largely preventable, but prevention requires a multi-sectorial approach

To a large extent, most NCD deaths are preventable. Up to 80% of heart disease, stroke and type II diabetes could be prevented by eliminating shared risk factors like tobacco use, unhealthy diet, physical inactivity and the harmful use of alcohol.[10] Tobacco consumption is the leading cause of avoidable death in the Americas; approximately one-third of all death from heart disease and cancer can be attributed to tobacco consumption.[11]

The greatest reductions in NCDs are expected to result from a comprehensive, population-wide approach to addressing risk factors.[12] These “best buys” include public

[5] Anderson, G.F., 2009.
[6] Abegunde, D.O., et al., 2007.
[7] Suhrcke, M. and R.A. Nugent, 2006.
[8] The World Bank, 2011.
[9] Barcelo, A., et al., 2003.
[10] World Health Organization, Primary 2008.
[11] World Health Organization, 2009.
[12] World Health Organization, 2010.

policy-based approaches to primary prevention, such as tobacco-control (taxes, advertising regulation, and smoking bans), alcohol regulations (taxes, advertising regulations, purchasing restrictions), and diet improvement (reducing salt [13] and replacing trans-fats in foods); public health interventions (promoting healthy diets, community-based physical activity promotion, among others); and primary care interventions (tobacco and alcohol counseling, multi-drug therapy for controlling risk factors, and screening and early treatment).[14]

The chronic disease model (Exhibit 3) has been proposed as a way to view these components of a chronic disease strategy designed to decrease incidence, reduce prevalence, and tackle ongoing treatment and rehabilitation.[15,16] The model shows that health systems have an essential role in NCD prevention and control strategies, but one that must be coordinated with other sectors and actors.[17]

There is evidence that existing interventions can address NCD challenges in low and middle income countries and although implementation requires strong delivery platforms, results can be cost-effective.[14] For example, secondary prevention of cardiovascular disease (CVD) through simplified non-laboratory risk screening to identify 6% of the population with CVD risk greater than 25% costs $1.20 per capita and can lead to a 20% reduction in CVD mortality.[18,19]

B. Primary care has an important role in NCD prevention and control strategies

Primary care contributes to NCD prevention and control through primary prevention of risk factors (promotion of physical activity, discouragement of smoking initiation), secondary prevention of complications resulting from existing risk factors, and tertiary prevention (rehabilitation and prevention of future complications resulting from stroke or uncontrolled diabetes). There is varied evidence of the effectiveness of primary care to perform all of these functions.[20] Perhaps the weakest evidence is for primary prevention, largely because adjustment of behavioral factors is complex, requires a sustained commitment over time, and often individual choices are constrained by the environment (e.g. availability of fresh food, places to perform physical activity, price and availability of cigarettes)--although there is

[13] Campbell, N.R.C., B. Legowski, and B. Legetic, 2011.
[14] Jamison, D.T., et al., 2006.
[15] Epping-Jordan, J.E., et al., 2005.
[16] Epping-Jordan, J.E., et al., 2004.
[17] Samb, B., et al., 2010.
[18] Gaziano, T.A., G. Galea, and K.S. Reddy, 2007.
[19] Gaziano, T.A., 2007.
[20] Wagner, E.H., et al., 2001.

evidence that regular contact with a primary care provider can enhance the extent to which individuals adhere to behavior change plans.[21, 22]

The bulk of evidence for primary care effectiveness seems to be in the area of secondary prevention via management of risk factors and coordination of care and medications obtained through specialty and hospital providers.[23] For example, diabetes control in primary care requires regular blood glucose monitoring, provision of glucose-lowering medications, effective control of cardiovascular risk factors, and coordination of other care and medications. Hypertension management requires blood pressure monitoring, prescription and adherence to anti-hypertensives, coordination of other care and medications, and lifestyle changes such as smoking cessation, diet and exercise counseling. Asthma requires assessment of asthma control, monitoring use of rescue inhaler, coordination of other care and medications. And chronic obstructive pulmonary diseases require smoking cessation counseling and more intensive referral and coordination of diagnostic and specialty care and medications. See Exhibit 4.

A validation study in Spain noted that the role of primary care in preventing avoidable hospitalizations differed by type of condition. For infectious diseases for which there was vaccine, primary care could play an important role in providing primary prevention. But for the majority of conditions, the expert panel concluded that primary care's principal role was in early diagnosis and timely treatment (e.g. ulcer, cardiac insufficiency, diabetes), or appropriate control and follow-up (e.g. diabetes, cardiovascular disease).[24] This study reinforces the importance of multisectorial approaches to primary prevention and the need for better integration of care across the treatment spectrum.

Of course, for primary care to contribute maximally to chronic disease prevention and control there are requirements beyond simply increasing access. The literature suggest a number of other features, including: enhancing practice design to improving access and follow-up, facilitating patient self-management through better communication and on-going support, improving the capacity of the healthcare team to provide high quality care through provider education and enhanced decision support, strengthening health service networks to facilitate access to diagnostic and needed specialist care, and improving information systems to facilitate the use of clinical records, patient and providers reminders, coordination of

[21] Coleman, K., et al., 2009.
[22] Forrest, C.B., et al., 2002.
[23] Bodenheimer, T., E.H. Wagner, and K. Grumbach, 2002.
[24] Caminal Homar, J., et al., 2003.

medications, and tracking outcomes over time. These features go beyond the individual primary care provider and require a health system-wide investment with appropriate resources and incentives.

I. Approaches to measuring primary care effectiveness

There is evidence that health systems with a strong primary care orientation achieve better health outcomes.[25] But several recent reports have documented major shortcomings that have left conventional health care systems unable to meet the needs of large numbers of people. These include the provision of "inverse care," whereby better-off people consume more care than people with less means and greater health needs; "impoverishing care," in which individuals and families who lack social protection fall into poverty as a result of catastrophic out-of-pocket expenses; "fragmented care" due to overspecialization, which prevents a holistic, continuous approach to people's care; "unsafe care" due to poor system design that fails to ensure safety and hygiene standards; and "misdirected care," whereby resources are allocated disproportionately toward curative care while neglecting prevention and health promotion. [10]

Recently, the World Health Organization has called for a global commitment to strengthening the primary care basis of health systems. [10] This strategy includes guaranteeing universal access and social protection, reorganizing health services around people's needs and expectations, implementing public policies that guarantee more healthy communities while integrating public health actions with those of primary care, reforming leadership to be more inclusive and participatory, and strengthening the scientific evidence and social support for primary care. [10] Each of these is ambitious objectives is congruent with strategies for strengthening the ability of primary care to tackle chronic disease. However, there is as yet little in the way of tools to aid low and middle income countries in assessing the performance of their primary care systems and their ability to achieve each of the objectives in the WHO strategy.

There have been advances in the measurement of primary care that allow for ascertainment of the functions of primary care services and providers.[26] These include approaches such as the Primary Care Assessment Tools which allow measures to be taken of the ability of a primary care practice or a whole network of primary care providers to provide

[25] Starfield, B., L. Shi, and J. Macinko, 2005.
[10]World Health Organization, Primary 2008.

first contact care, continued person-focused care over time, comprehensive care that meets most population health needs, to effectively coordinate care provided by other services and levels of the health system, culturally appropriate care, and to provide a link with community-based approaches to public health and health promotion. Such tools have been applied in several countries, including Brazil, Spain, New Zealand, Hong Kong, the USA and other countries, but have not, to date, been linked with the study of AH or other forms of health systems assessment.[27-37]

A. Hospitalizations for ambulatory care–sensitive conditions and primary care effectiveness

Hospitalizations for ambulatory care–sensitive conditions (also referred to as avoidable hospitalizations) have been used to monitor health system performance in the United States and in several European countries. The idea behind the indicator is that hospitalizations for certain health problems represent a failure of the health system to provide access to good quality primary care, which should have detected the condition early in its progression, reduced its severity, or prevented the appearance of complications, thus obviating the need for hospitalization. Avoidable hospitalization rates have been associated with primary care access and quality for adults as well as children in several countries, including Australia, Canada, Spain, and the United States.[38,42] Moreover, these conditions have been found to vary among different socioeconomic groups, even in countries with universal health coverage such as in Canada and Spain.[43-46] Avoidable hospitalizations have also been used to guide health planning, aid in policy making, evaluate the effects of health [28]policies, compare the performance of health systems, and identify inequalities between regions, communities and population groups.[38, 44, 46-48] However, these measures have only recently been used to study health system performance in low- and middle-income countries.

The use of avoidable hospitalization rates is based on the premise that timely and high quality primary health care can help to avoid hospital admissions altogether or at least reduce their frequency for some health problems deemed sensitive to primary care. In order to achieve this, primary care services must be effective and comprehensive, so that patients are

[27] Rocha, K.B., et al., 2007.
[38] Bermudez-Tamayo, C., et al., 2004.
[42] Laditka, J.N., S.B. Laditka, and J.C. Probst, 2005.
[43] Roos, L.L., et al., 2005.
[44] Shah, B.R., N. Gunraj, and J.E. Hux, 2003.
[46] Magan, P., et al., 2008.
[48] Gill, J.M. and A.G. Mainous, 3rd, 1998.
[49] Starfield, B., 2002.
[50] Caminal Homar, J., et al., 2001.
[51] Billings, J., N. Parikh, and T. Mijanovich, 2000.

hospitalized only in serious cases or when there are complications.[49] Good quality primary health care should improve population health by preventing the occurrence of disease and/or reducing the seriousness of health problems and their complications through health promotion, injury prevention, early diagnosis and treatment, disease management, and adequate follow-up of cases. For example, primary care actions can reduce hospital admissions for preventable infectious diseases through immunization (e.g. measles, tetanus, diphtheria and others) and prompt treatment (e.g. gastroenteritis and pneumonia), as well as reducing admissions, readmissions and length of hospital stay for acute complications of non-communicable diseases (e.g. diabetes, hypertension, and congestive heart failure).[50] Note that alongside the use of avoidable hospitalizations, there has been a parallel development of examination of emergency department (ED) use for a number of the same conditions.[51] These indicators are complementary to the avoidable hospitalizations conditions, since a number of the conditions for which people seek care at the ED are a result of poor access to primary care, and some of these may be less serious (and potentially of a higher volume) than those that actually required a hospital admission. To date, there appears to be less analysis of ED use than avoidable hospitalizations in low and middle income countries.

B. How is primary care related to avoidable hospitalizations for ambulatory care sensitive conditions?

The primary assumption behind the avoidable hospitalizations indicator is that for a given set of conditions, access to quality primary health care should have resulted in prevention or better management of these conditions to prevent hospitalizations or reduce their frequency. But how is this supposed to work in practice?

Specific aspects of primary care are thought to be associated with reductions in avoidable hospitalizations. These include access (measured most commonly by primary care physician density, health insurance, geographic distance to primary care providers), continuity of care[52,53], primary care ability to coordinate care provided at specialist and outpatient settings, and the comprehensiveness of care provided at the primary level. [52, 53] But these measures have been studied in only a handful of studies. Exhibit 5 presents a framework, adapted from Caminal and Casanova [54], for visualizing the ways in which

[52] Menec, V.H., et al., 2006.
[53] Menec, V.H., M. Sirski, and D. Attawar, 2005.
[54] Caminal Homar, J. and C. Casanova Matutano, 2003.
[55] Pandhi, N., et al., 2011.
[56] Bindman, A.B., et al., 2007.

primary care may act to reduce avoidable hospitalization rates. The figure identifies a number of contextual factors associated with the risk of hospitalization, including population characteristics (age and sex distribution, socioeconomic status, epidemiologic profile, insurance coverage), health provider characteristics (e.g. practice patterns, levels of training, incentives), health services (e.g. geographical location and distribution, financial barriers to access), health systems (e.g. norms for referral and counter-referral, practice guidelines, regulations and monitoring of quality standards), and health policy (factors affecting the distribution of risk factors in the population, availability of social safety nets). Given this overall context, an individual seeking care for a non-emergency condition would ideally first consult with their primary care provider and have their health problem resolved (sequence A). In a health system where primary care is the first point of contact, it is expected that the sequence A would dominate, especially given studies suggesting that good quality primary care is capable of resolving the majority of population health needs. [55, 56]

In sequence A1, individuals access primary care as the first point of contact and then are referred from primary to specialized or diagnostic care. Primary care thus plays its important coordination role and patients (and the information generated in the specialist encounter) return to the patient's primary care provider. It is expected that when sequence A and A1 are followed, rates of AH should be low.

In contrast, sequence B1 and B2 represent utilization patterns where primary care is either not easily accessible (due to geographic, financial, organization, or other barriers) or it does not perform its role as first contact care. In sequence B1, patients go directly to specialist providers without having consulted at primary care level. In sequence B2, patients go directly to emergency rooms or hospitals for care that could be managed at the primary care level.

Sequence C represents another sub-optimal pathway that may generate avoidable hospitalizations. In this scenario, patients present to primary care, but, due to either a) lack of previous access to primary care interventions, b) poor primary care quality provided, or c) lack of capacity at the primary care level to treat what should be a controllable condition, the individual is referred immediately to the emergency room or hospital.

Several studies also emphasize the importance of hospital and specialty care as additional factors that may affect avoidable hospitalization rates. If needed specialty care is not coordinated by primary care providers (whether due to structural barriers within the

health system or other factors such as insurance status or ability to pay) then this may also result in higher avoidable hospitalization rates. Likewise, hospitals with financial incentives to admit patients may have higher avoidable hospitalizations due to induced demand.

C. What constitutes an "ambulatory care sensitive" condition?

There may be different expectations for the way in which primary care acts to reduce avoidable hospitalizations. For some conditions, avoidable hospitalizations may be completely avoided, such as for hospitalizations related to immunization preventable conditions (e.g. measles, tetanus). Second are those acute conditions for which hospitalization could be reduced through early diagnosis and prompt treatment within primary care settings (e.g. dehydration, gastroenteritis). Third are those conditions for which primary care could reduce hospitalizations for acute complications (e.g. diabetic coma) and reduce admissions, re-admissions, and length of hospital stay (e.g. congestive heart failure). For this reason, the selection of the conditions which are included in the AH list is essential.

The US Agency for Healthcare Research and Quality (AHRQ) identified two main types of avoidable hospitalizations. Type 1 consists of conditions "for which the risk of hospitalization can be reduced, either through better outpatient management of chronic diseases (asthma, congestive heart failure--CHF, diabetes) or through more timely diagnosis and effective treatment of acute conditions (pneumonia, UTI, cellulitis)".[57] Type two consists of "conditions for which evidence exists that specific ambulatory care modalities reduce hospitalization rates." [57] The latter differs from category 1 because it specifically identifies problems in primary care, such as a lack of prior outpatient visits or antibiotic prescriptions. The AHRQ report notes that type 1 is the best validated and serves as the basis for their quality indicators. These include: dehydration, bacterial pneumonia, urinary infection, perforated appendix, angina, adult asthma, chronic obstructive pulmonary disease, congestive heart failure, diabetes (short and long term complications, uncontrolled diabetes, and lower extremity amputation), hypertension, low birth weight, pediatric asthma and pediatric gastroenteritis.[57]

[39] Ansari, Z., J.N. Laditka, and S.B. Laditka, 2006.
[57] Davies, S.M., et al., 2001.
[58] Purdy, S., et al., 2009.
[59] Alfradique, M.E., et al., 2009.
[60] Coleman, P. and J. Nicholl, 2010.
[61] Brown, A.D., et al., 2001. p. 155-9.
[62] Casanova, C. and B. Starfield, 1995.
[65] Parchman, M.L. and S. Culler, 1994.

Other recent efforts have been made to attempt to standardize the conditions and make more explicit their relationship to primary care.[58, 59] These have included techniques such as Delphi and other consensus based approaches.[60, 61] However, despite its uses in multiple countries, there is no international consensus concerning how the list of conditions should be composed and there are now several alternative lists used both among and within different countries. [39, 62-65]

The AHRQ provides a summary of evidence for their avoidable hospitalization indicators (they use the acronym ACSC) based on specific criteria. These include:

- Precision: All of the ACSC indicators can be measured relatively precisely, and all involve serious complications that are at least somewhat common.
- Minimum bias: Many factors that influence area healthcare utilization rates can also influence area ACSC rates. Other factors include environmental conditions for COPD and pediatric asthma. Socioeconomic status is related to ACSC rates and this can complicate attribution of differences in rates to problems in accessing primary care or other explanations such as patient preferences or hospital capacity.
- Construct validity: Better outpatient (primary) care can reduce complication rates that may generate an ACSC admission. Most of the ACSC rates are correlated with each other, suggesting a common underlying factor that influences them.
- Fosters true quality improvement: "Despite the relationships demonstrated at the patient level between higher-quality ambulatory care and lower rates of admission with subsequent complication, there is generally little evidence on whether improvements in access to high-quality care can reduce ACSC hospitalization rates in an area….On the other hand, there is also little evidence that use of these quality indicators would have any undesirable effects on hospital activities." [57]

Exhibit 6 provides a list of the most common conditions (that are also classified as NCDs) used in a selection of international studies. There appears to be more agreement on these conditions (with some important exceptions such as diabetes) than among some of the infectious and other conditions included in full lists of AH conditions used internationally.[59]

[59] Alfradique, M.E., et al., 2009.
[65] Parchman, M.L. and S. Culler, 1994.

III. State of the art and unanswered questions in using AH to study primary care and chronic disease control

This section is based on the literature as well as discussion with researchers about best practices, precautions and unanswered questions related to using avoidable hospitalization measures when assessing primary care and NCDs in low and middle income contexts. It is provided to stimulate further discussion and debate.

A. Data availability and quality

Most published studies use data from government administrative databases that were designed for payment. These claims data often have the advantage of being very large since they are based on individual patients and contain a variety of clinical and demographic data and are generally thought to be of good quality. Some limitations include the fact that in the United States, such claims are available only for individuals 65 years of or over or for those with access to Medicaid (which has different eligibility criteria in each state and so presents a serious selection issue). While a few other studies collect primary data based on emergency room or admissions data collected as a single hospital or within one city.[65] The latter may be one way to study avoidable hospitalizations in countries with decentralized healthcare management structures.

A key challenge for most low and middle income countries will be to identify appropriate national or regional databases, to verify the quality of the clinical data contained therein, and to assess the extent to which the data can be used for research and surveillance purposes. This includes having, at minimum, valid indicators of the patients' place of residence, age, sex and ideally information about other health services use, including other admissions, length of hospital stay, etc. In many public systems, managers and health providers may be skeptical about the quality of the diagnostic codes included in patient records. These may be influenced by poor record keeping or by financial or other incentives based on the way the hospital itself is financed. In addition to these possible systematic issues, analysis of time series data must also take into account compatibility with ICD9 and ICD10 codes is important as it affects several conditions included in most avoidable hospitalization condition lists.

Another important consideration is the scope of the database and the population is represents. In mixed public and private systems, it may be difficult or even impossible to capture all hospital use. This includes the ability to calculate meaningful denominators (what is the true population at risk for hospitalization in a public hospital if 25% of the population has private insurance?). Moreover, results can be skewed due to potential for selection bias, i.e. poorer patients may be sicker and use the public system, or private providers may not cover sicker patients or fail to cover some high-cost procedures.

B. Study design, measurement issues, and unit of analysis

Studies presented in Exhibit 7 range from simple correlations of avoidable hospitalization rates with SES measures, to natural experiments using panel data methods with instrumental variables. They include both explicit tests of the hypothesis that primary care can reduce avoidable hospitalizations alongside studies that infer this relationship based on results where avoidable rates are compared to all hospitalizations or a set of "non-avoidable" conditions for which hospitalizations are thought to be relatively stable.

An important source of variation among studies is the unit of analysis. The studies listed in Exhibit 7 vary from city (municipality, metropolitan statistical area), to state, to region, to national-level. Given the well-known modifiable areal unit problem (MAUP), the level of aggregation at which rates are measured by introduce different conclusions based on resulting differences in AH rates. The AHRQ recommends constructing denominators at the "area level" and (with the exception of perforated appendix and low birth weight rate) this is defined as the age- and sex-adjusted population rate of hospitalization with the procedure or diagnosis. For the exceptions, all hospitalized cases of appendicitis and all births are used. The authors note that "By constructing ambulatory-care sensitive condition indicators at the area level, outliers for these measures will not simply be hospitals that specialize in procedures or that happen to care for a disproportionate share of patients receiving poor outpatient care."[57] They also note that "because HCUP (healthcare utilization project) data do not include specific information on patient residence (e.g., zip code), it is not possible to construct meaningful measures of area rates for very small areas. The smallest feasible area

for analysis is the level that provides relatively modest "leakage" into or out of hospitals within the area at the level of metropolitan statistical areas (MSA)." [57]

The studies differ to the extent to which they explicitly include measures of primary care. Many studies assess variations in avoidable hospitalizations occur either by geography or by population groups. Authors often attribute these variations to poor access to and quality of primary care, but do not always explicitly include measures of primary care access, utilization, or quality. Others note that factors such as practice patterns at the hospital, induced demand at the hospital, or other aspects of the health system that could be driving such results.

An essential challenge for many potential uses of the indicator is that of obtaining appropriate information on denominators. Basic demographic information may be unavailable at each geo-political unit for each year. It may not be available foe age-specific groups and these age groups may not match the age groups present in the numerator. Further, there is a tension in the literature over using the entire population in an area or attempting to construct a more precise measure of the population at risk of hospitalization in that particular hospital. This has been accomplished by counting only those with a certain type of insurance, those with a certain type of benefit plan, or by limiting analysis to specific hospital catchment areas.

C. Data analysis

The studies also demonstrate a variety of different approaches to data analysis. A number of the studies listed in exhibit 7 perform ecological-level analyses to compare changes of aggregate level avoidable hospitalization rates with changes in other factors, such as primary care supply. Other studies take advantage of claims data to assess rates at the individual-level, while controlling for confounders such as co-morbidity or illness severity of each individual.

Because it can be difficult to obtain data and to create stable rates at small areas of analysis, some studies use count models (e.g. Poisson or negative binomial) to perform multivariable analyses or to measures rates of change. Other studies prefer to construct rates and often perform demographic adjustment to these rates before then using them in multivariable models. These two approaches may yield somewhat different conclusions

[57] Davies, S.M., et al., 2001.

depending on how the rates are calculating, the means of rate adjustment used, and the type of analysis performed.

Numerous studies have found adjustment for other chronic conditions (comorbidities) as well as other risk factors (age, sex), and some behaviors (smoking) can change the interpretation of rates (as above or below expected values, or affecting the ranking of different health services areas). Careful adjustment for these factors is essential, yet many countries do not have individual-level "claims" data and those that do may not have it available in such a way as to do risk adjustment. Moreover, there are numerous ways to adjust for such risks and using different methods may result in different results. The studies presented in the annex differ greatly in availability of individual-level claims data and the subsequent choice of risk adjustment methods.

Another important difference among studies is whether they assess avoidable hospitalization measures (specific diagnostic codes) as a group or condition by condition. Many of the avoidable hospitalization indicators were developed as part of a set designed to comprehensively examine access to care. These indicators have been most often validated as a set and not individually and AHRQ recommends using them together as a set may be particularly ideal, since the evidence for some of these indicators alone is unclear. But at the same time, it may well be that the primary care actions needed to prevent hospitalizations from different conditions may be quite different (e.g. primary versus secondary versus tertiary prevention) and this might require disaggregating the conditions further.

Finally, studies differ dramatically in the inclusion of other factors in multivariable models. These include measures related to the hospital itself, the presence of different types of insurance or payment modalities, means of controlling for yearly trends and fixed effects. There is evidence that individual risk factors (such as illness severity) are associated with poorer access to primary care prior to the hospitalization as well as poor hospital capacity in rural areas to deal with highly advanced cases.[66,67] Current and previous smoking as well as severe alcohol misuse is also associated with higher avoidable hospitalization rates although these measures are available in only a handful of datasets.[68]

[66] Basu, J., 2005.
[67] Yuen, E.J., 2004.
[68] Chew, R.B., et al., 2011.

IV. An agenda for advancing knowledge on avoidable hospitalizations and their use to understand the effectiveness of primary (health) care in chronic disease control in low and middle income countries

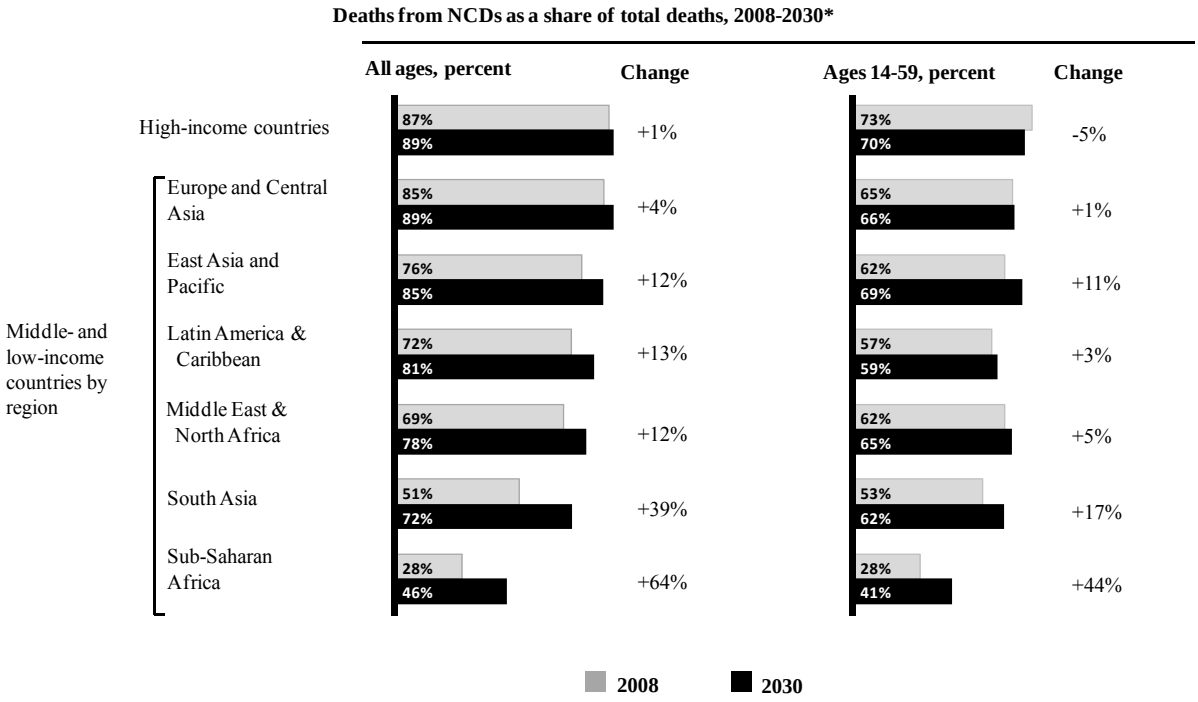
This section provides elements of a knowledge agenda seeking to advance understanding about avoidable hospitalizations as a diagnostic tool for assessing health system performance. The objective is to stimulate debate and lay out a series of questions that may benefit from an international collaborative approach to research and action.

- What is the role of primary health care in preventing avoidable hospitalizations? Does it differ by condition, by population, by health system?
- Are declining rates of avoidable hospitalizations an indicator of better access to primary care or better quality of care or both? What is the best way to understand these differences?
- Does analysis of avoidable hospitalizations depend on the development and validation of a single list of conditions? Can the validation be done in a way to make the conditions (or at least a subset thereof) similar across time, geography, and health system type?
- If primary care's most important role is in secondary and tertiary prevention, how does the use of avoidable hospitalization as an indicator avoid promoting an overly medicalized, organ-based approach to people's health? This could be considered contrary to a longitudinal, whole person-based approach often considered a hallmark of good quality primary care.
- How do approaches to priority setting and technology assessment relate to chronic disease prevention in primary care? Are all the available tools available at the primary care level in most countries? Are all the most important treatments available? Are primary care providers up-to-date in their knowledge and ability to use these technologies and treatments?
- What is the role of primary health care within primary care? That is, how to maximize both the clinical contribution (primary care) and the wider set of policies and actions linking clinical care to public health and intersectorial actions?
- What is the role of human resources? Which professionals have which functions in primary care? Is there a gold standard for what level of training for each action? How can teams be made to perform more effectively and efficiently? And how should

universities and professional training programs be structured to assure that the right type of professionals with the right kind of training are available when they are needed and into the future?

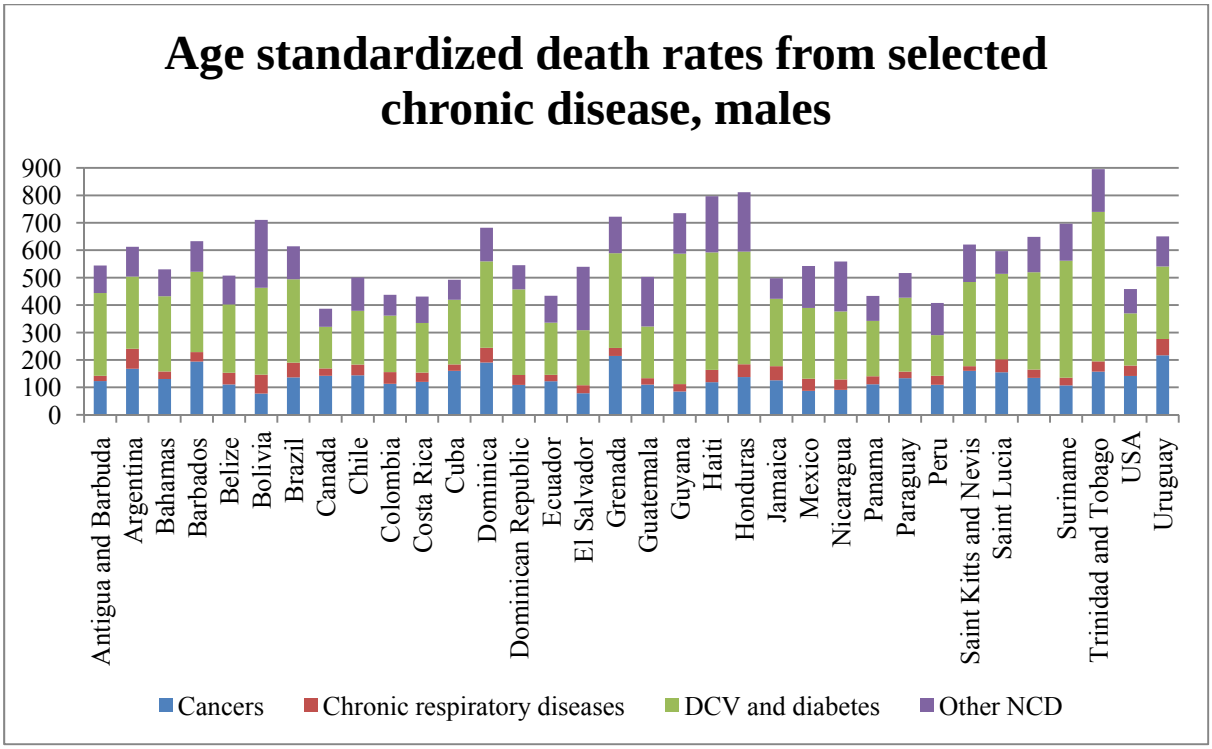
- What is the role of incentives within the health system in assuring that potentially avoidable hospitalizations are actually reduced? How do cost pressures at the hospital-level influence admission decisions? How do payment mechanisms at the hospital level (e.g. fee for service) and primary care level (e.g. capitation) create incentives for primary care to under-treat or hospitals to over-admit?

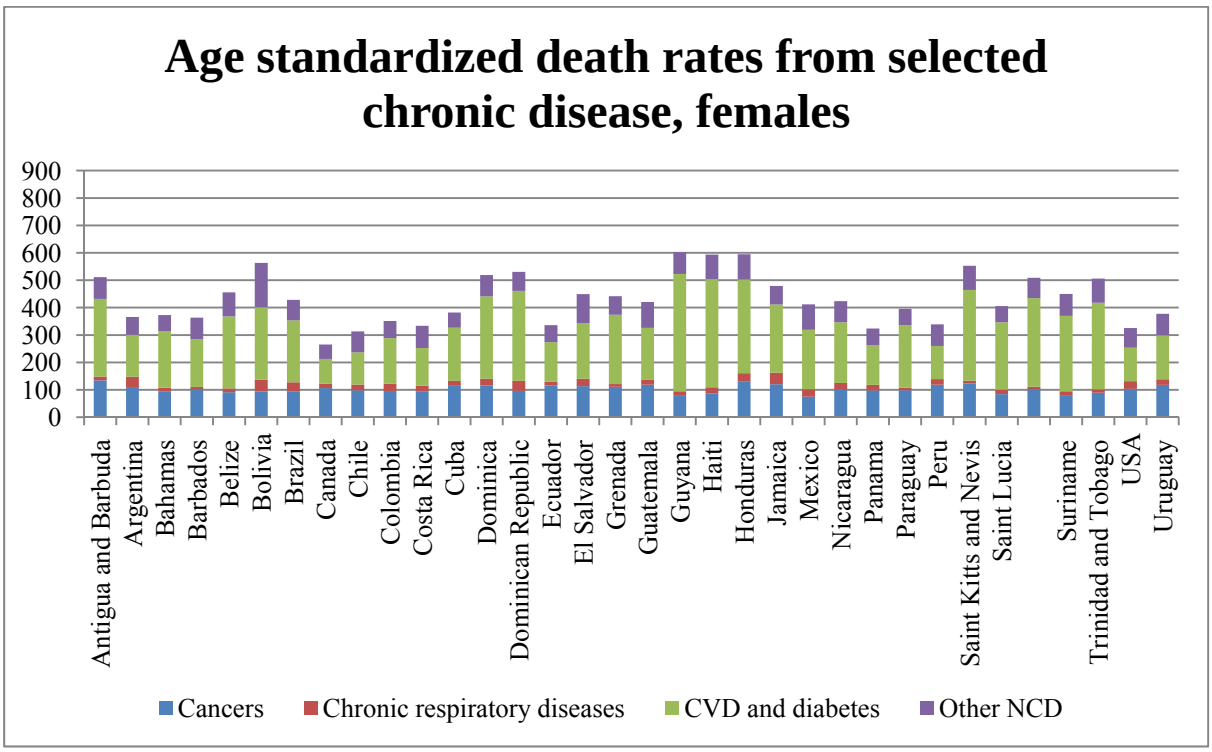
Exhibit 1: The Rising NCD Challenge and Younger Populations



Sources: "Chronic Emergency: Why NCDs Matter." *Health, Nutrition, and Population Discussion Paper*. 2011. Washington DC: World Bank.
Notes: *Analysis by region uses WHO updated estimates for 2008 and baseline projections for 2030; analysis by income group uses WHO 2008-2030 baseline projections.

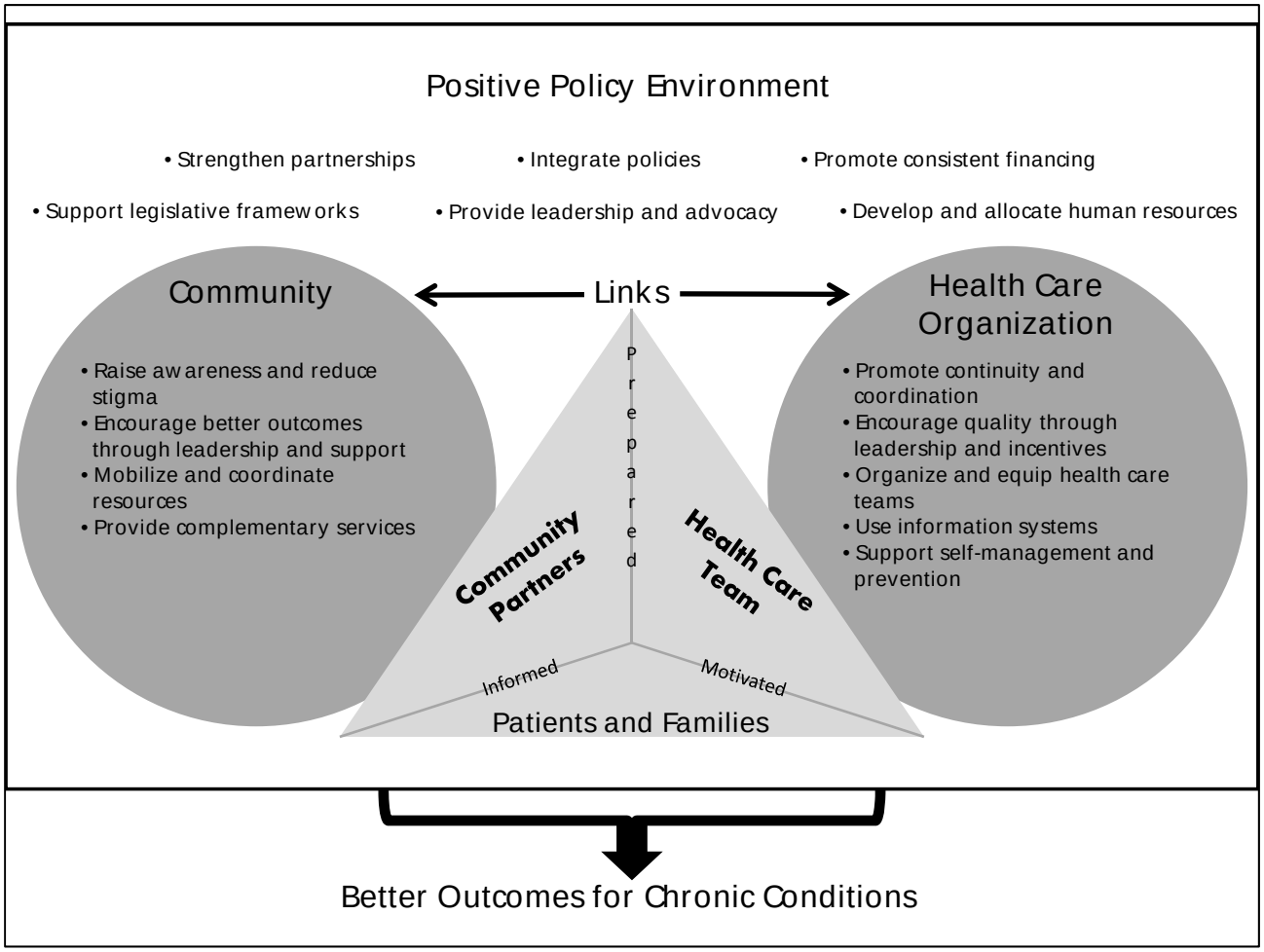
Exhibit 2: WHO estimates of age-adjusted chronic disease mortality rates, 2010





Source: WHO Global Infobase (https://apps.who.int/infobase/Index.aspx)

Exhibit 3: The Chronic Disease Model



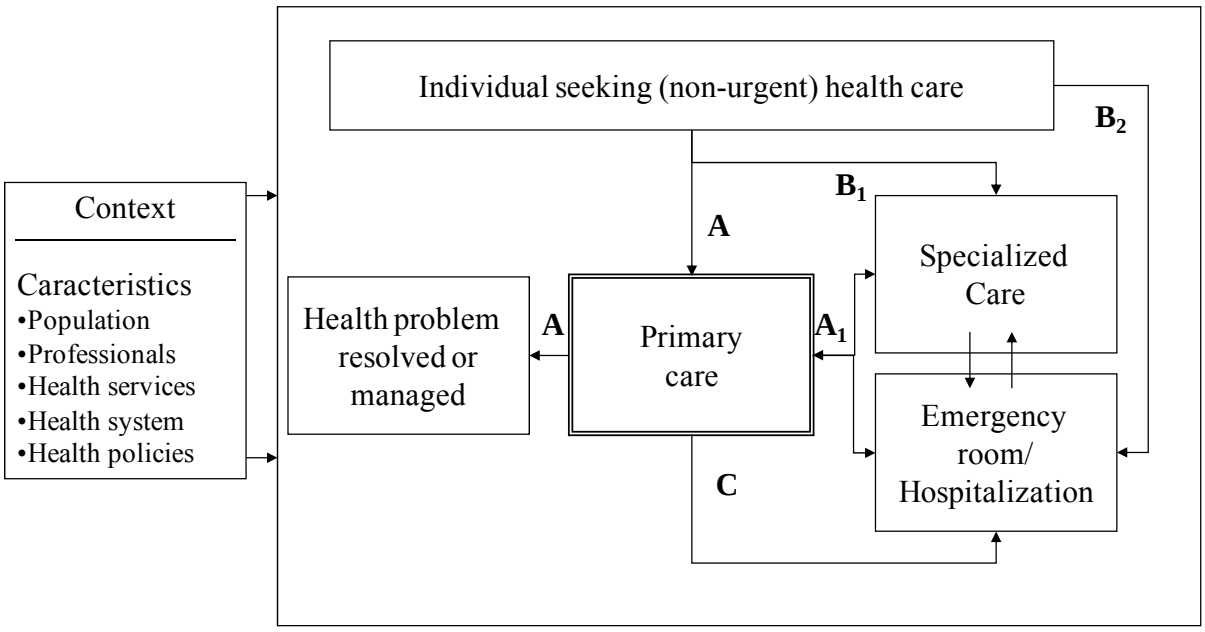
Source: Adapted from [15, 16]

[15] Epping-Jordan, J.E., et al., 2005.
[16] Epping-Jordan, J.E., et al., 2004.

Exhibit 4: Primary care and NCD prevention and control

NCD	Main primary health care actions
Preventable cancers (breast, cervical, colon, prostate, lung)	Regular screening, smoking cessation, diet and exercise counseling, coordination of other care (including diagnostic tests not available in primary care)
Diabetes	Blood glucose monitoring, glucose-lowering medications, control of cardiovascular risk factors, coordination of other care and medications.
Hypertension	Blood pressure monitoring; prescription and adherence to anti-hypertensives; smoking cessation, diet and exercise counseling; coordination of other care and medications.
Other cardiovascular diseases (angina, AMI)	Blood pressure monitoring; prescription and adherence to anti-hypertensives and lipid-lowering drugs; smoking cessation, diet and exercise counseling; coordination of other care and medications.
Cerebrovascular diseases (stroke)	Blood pressure monitoring; prescription and adherence to medications; smoking cessation, diet and exercise counseling; coordination of other care and medications, post-stroke rehabilitation.
Asthma	Assessment of asthma control, monitoring use of rescue inhaler, coordination of other care and medications.
Chronic Obstructive Pulmonary Disease	Smoking cessation counseling; referral and coordination of diagnostic and specialty care and medications.

Exhibit 5: Conceptual Framework for AHs and Primary Care



A= primary care is first contact into the health system; individual treated in primary care
A_1= primary care is first contact into the health system; individual referred by primary care
B_1/B_2= primary care is not first contact into the health system
C= primary care not able to resolve problem (due to lack of access, capacity, or quality)

Source: Adapted from Caminal and Casanova, 2003

Exhibit 6: Most common NCD conditions included in studies of AH

Conditions (ICD10)	Brazil[59]	Spain[24]	Australia[69]	USA[70]	Canada[61]	USA[71]	Ontario[44]	USA[72]	Singapore[73]
Asthma (J45, J46)	X	X	X	X	X	X	X	X	X
Chronic obstructive pulmonary disease							X		
J40	X	X	-	-	-	-	N.A.	-	X
J41	X	X	X	-	-	X	N.A.	-	X
J42	X	X	X	X	-	X	N.A.	-	X
J43	X	X	X	X	-	X	N.A.	-	X
J47	X	X	X	X	-	X	N.A.	-	X
J44	X	X	X	X	-	X	N.A.	-	X
Hypertension									
I10	X	X	X	X	X	X	X	-	X
I11	X	X	X (I11.9)	X	X	X	X	-	X
I10.0, I11.0, I12.0, I13.0, I67.4, I15.9	-	-	-	-	-	-	-	-	X
Angina pectoris (I20, I24)	X	X	X (I24.0, I24.8-9)	X	X	X	X	X	-
Heart disease							X		
I50	X	X	X	X	X	X	N.A.	X	X
I13.9, I11.9	-	-	-	-	-	-	-	-	X
J81	X	X	X	X	-	X	N.A.	-	-
J21 (AMI)	-	X	-	-	-	-	N.A.	-	-
Cerebrovascular diseases (I60-69)	X	X	-	-	-	X	-	-	-
Diabetes mellitus		X	X (I11.0)	X	-	-	-	-	
E10.0 - E10.1 E11.0 - E11.1	X	X	X	X	-	X	X	-	X
E12.0 - E12.1	X	X	X	X	-	X	X	-	X
E13.0 - E13.1	X	X	X	X	-	X	X	-	X
E14.0 - E14.1	X	X	X	X	-	X	X	-	X
E10.2 - E10.8 E11.2 - E11.8	X	X	X	X	-	X	-	-	-
E12.2 - E12.8	X	X	X	X	-	X	-	-	-
E13.2 - E13.8	X	X	X	X	-	X	-	-	-
E14.2 - E14.8	X	X	X	X	-	X	-	-	-
E10.9, E11.9	X	X	X	X	-	X	-	-	-
E12.9, E13.9	X	X	X	X	-	X	-	-	-
E14.9	X	X	X	X	-	X	-	-	-
E16.1 - E16.2	-	X	-	X	-	X	X (iatrogenic)	-	X
Epilepsy									
G40, G41	X	X	X	X	-	X	X	X	-
R56	-	X	X	X	-	-	-	+-	-

X = present in list; "-" =absent in list; N/A = study used only larger ICD categories

Exhibit 7: Selected studies on AH and primary care

Study, region, year	Primary Care Measure	Controls	Analytic technique	AH Measure	Results
Agabiti Italy 2009	None	Age, gender, city of residence (Turin, Milan, Bologna, Rome)	Poisson regression analysis	Diabetes, hypertension, congestive heart failure, angina pectoris, COPD, and asthma; ICD-9-CM, (from AHRQ)	Low income people more likely to be hospitalized; socioeconomic gradient in ACSC hospitalization rates confirms gap in health status between social groups in Italy; insufficient or ineffective PC suggested as plausible factor aggravating inequality.
Billings Canada, US 1996	None	Age, sex, area-level income	Linear regression	Billings ACSC list (ICD-9-CM for US, ICD-9 for Canada)	Large differences in admissions between low- and high-income areas remained regardless of citywide rates or geographic area; strong association in US urban areas between low-income residents ACS rates; No income gradient in Toronto, even for chronic conditions (eg, asthma, diabetes)
Blustein USA 1998	Access to care, propensity to receive care	Age and sex, general health status, insurance, education; income, prior medical history	Descriptive stats, bivariate associations, multivariate models	Billings ACSC list (ICD-9-CM (21 conditions)	Among Medicare beneficiaries, low SES associated with poor health; poorer, sicker, and less-educated elders more prone to ACSC hospitalization; using preventable hospitalizations as indicators of health plan quality without proper adjustment is prone to substantial bias.
Chang USA 2011	Adult primary care physician workforce (general internists and family physicians)	Age, sex, race, presence of chronic conditions, income, specialty mix, hospital bed capacity	Multilevel Poisson models	12 ACSC from AHRQ (convulsions, COPD, pneumonia, asthma, CHF, hypertension, angina, cellulitis, diabetes, gastroenteritis, kidney or urinary infection, and dehydration)	A higher level of PC physician workforce, particularly with an FTE measure, was generally associated with lower AH hospitalizations, lower mortality, and lower medical costs.
Correa-Velez Australia 2007	None	Age, sex	Standardized rate ratios with confidence levels based on gamma distribution	classification for ACSC applied in Victorian Ambulatory Care Sensitive Conditions Study (acute, chronic, and vaccine-preventable categories), using ICD-10-AM	Preventable hospitalizations among people born in refugee-source countries were no higher than Australia-born population averages.

Dourado Brazil 2011	Family Health Program (FHP) (enrolment) at the state level	Age, sex, living conditions, availability of healthcare services, year trends	Fixed effects multivariate negative binomial regression	Brazil ACSH list	PHCSC hospital admissions declined by 24% at national level; at state level, regression models showed the greater the FHP coverage, the less PHCSC hospital admissions
Fiorentini Italy (Emilia-Romagna region) 2010	GP pay-for-performance, pay-for-participation, and pay-for-compliance schemes	For GPs: gender, age, practice location, type of practice for patients: gender, age, comorbidities. For district: hospitalization rate, total beds	Three-level logit model	27 medical diagnostic related groups (DRGs) selected by Emilia-Romagna region vs. ACSCs developed by Billings (ICD-9-CM)	Pay-for-performance schemes may have significant effect over aggregate indicators of appropriate use of health resources; effectiveness of pay-for-participation schemes captured only by taking into account subpopulations affected by specific diseases; performance improvements limited to the specific policy targets.
Giuffrida UK 1999	None	Age, sex, co-morbidities	Multiple regression analysis	Asthma, diabetes, epilepsy (ICD-10)	At health authority level, socioeconomic characteristics, health status, and secondary care resources explained 45%, 33%, and 55% of variation in admission rates for asthma, diabetes, and epilepsy, respectively
Guanais Brazil 2009	Expansion of the Family Health Program (FHP) and Community Health Agents Program (PACS)	% municipal health expenditures, quartiles of municipal ambulatory care facilities, health exp./ capita, ambulatory facilities and hospital beds per 1000, illiteracy rates, clean water supply, per capita income, percentage of municipal pop ≥60, female pop ≥60, total female pop	Multivariate longitudinal analysis (using panel data); with fixed-effects specification in municipalities with good quality data	Diabetes mellitus; respiratory and circulatory conditions	FHP expansions associated with reductions in hospitalizations for diabetes mellitus and respiratory problems; CHAP expansions associated with reductions in circulatory conditions hospitalizations; these impacts were found only in women.
Hossain South Carolina 2009	GP supply	Population lifestyle, SES, physician practice behaviors, pop tendency to use health care resources, and disease prevalence	Multivariate spatial factor analysis	Diabetes complications, uncontrolled diabetes, lower extremity amputation, adult asthma, hypertension, dehydration, UTI, bacterial pneumonia, angina w/o procedure, COPD, CHF	For South Carolina pop ≥18, counties with high rates of ED visits had less access to Primary Care; no community health centers were found in these counties, suggesting CHCs improve PC access.

Macinko Brazil 2011	Family Health Program (FHP) (% population covered in microregions 1999-2007)	Log income per capita, clean water, illiteracy, health insurance, medical consultations per capita, premature mortality	Dynamic panel estimation	Brazil ACSH list	Higher FHP coverage associated with lower ACS rates; higher private/non-profit contracted hospital beds associated with higher ACS rates.
Macinko Brazil 2010	Family Health Program (FHP) (% population covered in municipalities 1999-2007)	Log pop size, age distribution, log income, illiteracy rate among women, access to clean water, public and private hospital beds per 10,000 inhabitants, percentage of pop with private health insurance	Fixed-effects negative binomial regression approach with instrumental variables	Brazil ACSH list; selected most important chronic conditions that can be controlled through PC actions	Hospitalizations for main chronic diseases fallen significantly since 1999; expansion of FHP associated up to 13% of this decline.
Magan Spain (Community of Madrid) 2008	Geographic variation in GP density (implicit)	Age, sex-adjusted rates constructed by sanitary districts. All subjects >65 years	Coeff. of variation, systematic coeff of variation, weighted coeff of variation, ratio of variation, Chi-square, Student's t, Pearson correlation	ACSH selected from list of conditions validated for Spain by Caminal et al. (based on ICD-9-CM)	Significant variation in "preventable" hospitalizations b/w districts; in all, men present rates higher than women; important variations in access despite universal health coverage.
Mendonca Brazil (Belo Horizonte) 2011	Family Health (FHP) coverage by census tract in BH from 2003-2006	FHP team coverage by census tract, area-level social vulnerability index, team time of operation, physician time with FHP team	Mixed model analysis (random coefficient model)	Brazil ACSH list	FHS contributed to reduction in hospitalizations due to primary care sensitive conditions while promoting greater health equality; 18% decrease in hospitalizations for sensitive conditions over 4yr period soon after large-scale implementation of FHS.
Nede Brazil (Bagé) 2008	Family Health Program (FHP)	Age, sex, model of care	Poisson model	Brazilian ACSC list	ACSC accounted for 42.6% of hospitalizations; lower probability of ACSC among patients in Family Health Areas and among FHP users
Rizza Italy (Catanzaro) 2007	# patients/GP, PCP access in past year, satisfaction with PCP	Age, sex, health-status, age, risk factors	Multivariate logistic regression analysis of random sample of 520 patients in hospital	Cardiovascular diseases, respiratory diseases, and diabetes from AHRQ list	Proportion of patients who had preventable hospitalization significantly increased with regard to number of hospital admissions in previous year and to number of patients for each PCP, with lower number of PCP accesses and PCP medical visit in previous year, with less satisfaction about PCP health service, and with worse self-reported health status and shorter length of hospital stay.

Saha Oregon 2007	No PC measure (PC access implicitly assumed)	Age-sex standardize rates (Medicaid, Medicaid plus uninsured, uninsured population)	Logistic regression models, retrospective, time series analysis before/after health insurance expansion	Principal diagnosis of asthma, cellulitis, CHF, diabetes, gangrene, hypertension; or secondary diagnosis of asthma and COPD if primary diagnosis was pneumonia or bronchitis (ICD-9-CM)	Annual preventable hospitalization (PH) rates in the Medicaid + uninsured pop increased after eligibility expansion; non-Medicaid insured population experienced slight decline in annual PH rates.

References

Abegunde, D.O., et al., The burden and costs of chronic diseases in low-income and middle-income countries. Lancet, 2007. 370(9603): p. 1929-38.

Alfradique, M.E., et al., [Ambulatory care sensitive hospitalizations: elaboration of Brazilian list as a tool for measuring health system performance (Project ICSAP--Brazil)]. Cad Saude Publica, 2009. 25(6): p. 1337-49.

Anderson, G.F., Missing in action: international aid agencies in poor countries to fight chronic disease. Health Aff (Millwood), 2009. 28(1): p. 202-5.

Ansari, Z., et al., The Victorian Ambulatory Care Sensitive Conditions study: reducing demand on hospital services in Victoria. Aust Health Rev, 2002. 25(2): p. 71-7.

Ansari, Z., J.N. Laditka, and S.B. Laditka, Access to health care and hospitalization for ambulatory care sensitive conditions. Med Care Res Rev, 2006. 63(6): p. 719-41.

Barcelo, A., et al., The cost of diabetes in Latin America and the Caribbean. Bull World Health Organ, 2003. 81(1): p. 19-27.

Basu, J., Severity of illness, race, and choice of local versus distant hospitals among the elderly. J Health Care Poor Underserved, 2005. 16(2): p. 391-405.

Bermudez, D. and L. Baker, The relationship between SCHIP enrollment and hospitalizations for ambulatory care sensitive conditions in California. J Health Care Poor Underserved, 2005. 16(1): p. 96-110.

Bermudez-Tamayo, C., et al., [Organizational characteristics of primary care and hospitalization for to the main ambulatory care sensitive conditions]. Aten Primaria, 2004. 33(6): p. 305-11.

Berra, S., et al., Properties of a short questionnaire for assessing primary care experiences for children in a population survey. BMC public health, 2011. 11: p. 285.

Billings, J., N. Parikh, and T. Mijanovich, Emergency department use in New York City: a substitute for primary care? Issue Brief (Commonw Fund), 2000(433): p. 1-5.

Bindman, A.B., et al., Diagnostic scope of and exposure to primary care physicians in Australia, New Zealand, and the United States: cross sectional analysis of results from three national surveys. BMJ, 2007. 334(7606): p. 1261.

Bindman, A.B., et al., The impact of Medicaid managed care on hospitalizations for ambulatory care sensitive conditions. Health Serv Res, 2005. 40(1): p. 19-38.

Bodenheimer, T., E.H. Wagner, and K. Grumbach, Improving Primary Care for Patients With Chronic Illness: The Chronic Care Model, Part 2. JAMA, 2002. 288(15): p. 1909-1914.

Brown, A.D., et al., Hospitalization for ambulatory care-sensitive conditions: a method for comparative access and quality studies using routinely collected statistics. Can J Public Health, 2001. 92(2): p. 155-9.

Caminal Homar, J. and C. Casanova Matutano, [Primary care evaluation and hospitalization due to ambulatory care sensitive conditions. Conceptual framework]. Aten Primaria, 2003. 31(1): p. 61-5.

Caminal Homar, J., et al., [Hospitalizations preventable by timely and effective primary health care]. Aten Primaria, 2003. 31(1): p. 6-14; discussion 16-7.

Caminal Homar, J., et al., [Primary health care and hospitalizations in ambulatory care sensitive conditions in Catalonia]. Rev Clin Esp, 2001. 201(9): p. 501-7.

Campbell, N.R.C., B. Legowski, and B. Legetic, Mobilising the Americas for dietary salt reduction. The Lancet, 2011. 377(9768): p. 793-795.

Casanova, C. and B. Starfield, Hospitalizations of children and access to primary care: a cross-national comparison. Int J Health Serv, 1995. 25(2): p. 283-94.

Cassady, C.E., et al., Measuring consumer experiences with primary care. Pediatrics, 2000. 105(4 Pt 2): p. 998-1003.

Chew, R.B., et al., Are smoking and alcohol misuse associated with subsequent hospitalizations for ambulatory care sensitive conditions? J Behav Health Serv Res, 2011. 38(1): p. 3-15.

Coleman, K., et al., Evidence On The Chronic Care Model In The New Millennium. Health Aff, 2009. 28(1): p. 75-85.

Coleman, P. and J. Nicholl, Consensus methods to identify a set of potential performance indicators for systems of emergency and urgent care. J Health Serv Res Policy, 2010. 15 Suppl 2: p. 12-8.

Davies, S.M., et al., Refinement of the HCUP Quality Indicators, in Technical Reviews, No. 42001, US Agency for Healthcare Research and Quality: Rockville, MD.

Epping-Jordan, J.E., et al., Improving the quality of health care for chronic conditions. Qual Saf Health Care, 2004. 13(4): p. 299-305.

Epping-Jordan, J.E., et al., Preventing chronic diseases: taking stepwise action. Lancet, 2005. 366(9497): p. 1667-71.

Fleming, S.T., Primary care, avoidable hospitalization, and outcomes of care: a literature review and methodological approach. Med Care Res Rev, 1995. 52: p. 88-108.

Forrest, C.B., et al., Managed Care, Primary Care, and the Patient-practitioner Relationship. J Gen Intern Med, 2002. 17(4): p. 270-277.

Gaziano, T.A., G. Galea, and K.S. Reddy, Scaling up interventions for chronic disease prevention: the evidence. Lancet, 2007. 370(9603): p. 1939-46.

Gaziano, T.A., Reducing the growing burden of cardiovascular disease in the developing world. Health Aff (Millwood), 2007. 26(1): p. 13-24.

Gill, J.M. and A.G. Mainous, 3rd, The role of provider continuity in preventing hospitalizations. Arch Fam Med, 1998. 7(4): p. 352-7.

Guttmann, A., et al., Primary care physician supply and children's health care use, access, and outcomes: findings from Canada. Pediatrics, 2010. 125(6): p. 1119-26.

Harzheim, E., et al., [Internal consistency and reliability of Primary Care Assessment Tool (PCATool-Brasil) for child health services]. Cadernos de saude publica / Ministerio da Saude, Fundacao Oswaldo Cruz, Escola Nacional de Saude Publica, 2006. 22(8): p. 1649-59.

Hoehner, C.M., et al., Physical activity interventions in Latin America: a systematic review. Am J Prev Med, 2008. 34(3): p. 224-233.

Jamison, D.T., et al., eds. Disease Control Priorities in Developing Countries. 2nd Edition. 2006, The World Bank/Oxford University Press: Washington, DC.

Jatrana, S., P. Crampton, and K. Richardson, Continuity of care with general practitioners in New Zealand: results from SoFIE-Primary Care. The New Zealand medical journal, 2011. 124(1329): p. 16-25.

Jeon, K.Y., Cross-cultural adaptation of the US consumer form of the short Primary Care Assessment Tool (PCAT): the Korean consumer form of the short PCAT (KC PCAT) and the Korean standard form of the short PCAT (KS PCAT). Quality in primary care, 2011. 19(2): p. 85-103.

Laditka, J.N., S.B. Laditka, and J.C. Probst, More may be better: evidence of a negative relationship between physician supply and hospitalization for ambulatory care sensitive conditions. Health Serv Res, 2005. 40(4): p. 1148-66.

Laditka, J.N., S.B. Laditka, and M.P. Mastanduno, Hospital utilization for ambulatory care sensitive conditions: health outcome disparities associated with race and ethnicity. Soc Sci Med, 2003. 57(8): p. 1429-41.

Lopez, A.D., C.D. Mathers, and M. Ezzati, eds. Global Burden of Disease and Risk Factors. 2006, The World Bank: Washington, DC.

Macinko, J., C. Almeida, and P.K. de Sa, A rapid assessment methodology for the evaluation of primary care organization and performance in Brazil. Health Policy and Planning, 2007. 22(3): p. 167-77.

Magan, P., et al., Geographic variations in avoidable hospitalizations in the elderly, in a health system with universal coverage. BMC Health Serv Res, 2008. 8: p. 42.

Malouin, R.A., B. Starfield, and M.J. Sepulveda, Evaluating the tools used to assess the medical home. Managed care, 2009. 18(6): p. 44-8.

Menec, V.H., et al., Does continuity of care with a family physician reduce hospitalizations among older adults? J Health Serv Res Policy, 2006. 11(4): p. 196-201.

Menec, V.H., M. Sirski, and D. Attawar, Does continuity of care matter in a universally insured population? Health Serv Res, 2005. 40(2): p. 389-400.

Nedel, F.B., et al., Family Health Program and ambulatory care-sensitive conditions in Southern Brazil. Rev Saude Publica, 2008. 42(6): p. 1041-52.

Niti, M. and T.P. Ng, Avoidable hospitalisation rates in Singapore, 1991-1998: assessing trends and inequities of quality in primary care. J Epidemiol Community Health, 2003. 57(1): p. 17-22.

Pan American Health Organization, Health in the Americas2007, Washington, DC: PAHO/WHO.

Pandhi, N., et al., Preventive service gains from first contact access in the primary care home. J Am Board Fam Med, 2011. 24(4): p. 351-9.

Parchman, M.L. and S. Culler, Primary care physicians and avoidable hospitalizations. J Fam Pract 1994. 39: p. 123-8.

Pasarin, M.I., et al., [An instrument to evaluate primary health care from the population perspective]. Atencion primaria / Sociedad Espanola de Medicina de Familia y Comunitaria, 2007. 39(8): p. 395-401.

Purdy, S., et al., Ambulatory care sensitive conditions: terminology and disease coding need to be more specific to aid policy makers and clinicians. Public Health, 2009. 123(2): p. 169-73.

Ricketts, T.C., et al., Hospitalization rates as indicators of access to primary care. Health Place, 2001. 7(1): p. 27-38.

Rivera, J.A., et al., Nutrition transition in Mexico and in other Latin American countries. Nutr Rev, 2004. 62(7 Pt 2): p. S149-57.

Rocha, K.B., et al., Assessment of primary care in health surveys: a population perspective. European journal of public health, 2011.

Roos, L.L., et al., Physician visits, hospitalizations, and socioeconomic status: ambulatory care sensitive conditions in a canadian setting. Health Serv Res, 2005. 40(4): p. 1167-85.

Samb, B., et al., Prevention and management of chronic disease: a litmus test for health-systems strengthening in low-income and middle-income countries. The Lancet, 2010. 376(9754): p. 1785-1797.

Shah, B.R., N. Gunraj, and J.E. Hux, Markers of access to and quality of primary care for aboriginal people in Ontario, Canada. Am J Public Health, 2003. 93(5): p. 798-802.

Starfield, B., Atenção Primária: equilíbrio entre necessidades de saúde, serviços e tecnologia2002, Brasília: UNESCO/Ministério da Saúde.

Starfield, B., L. Shi, and J. Macinko, Contribution of primary care to health systems and health. Milbank Q, 2005. 83(3): p. 457-502.

Starfield, B., Primary Care: Balancing Health Needs, Services and Technology1998, New York: Oxford University Press.

Suhrcke, M. and R.A. Nugent, Chronic Disease: An Economic Perspective2006, London: Oxford Health Alliance.

The World Bank, The Growing Danger of Non-Communicable Diseases: Acting Now to Reverse CourseSeptember 2011, Washington, DC: The World Bank.

Tsai, J., et al., Usual source of care and the quality of medical care experiences: a cross-sectional survey of patients from a Taiwanese community. Medical care, 2010. 48(7): p. 628-34.

Valenzuela Lopez, M.I., et al., [To identify primary care interventions that reduce hospitalisation of people over 65 due to ambulatory care sensitive conditions]. Aten Primaria, 2007. 39(10): p. 525-32.

Victorian Government Department of Human Services, The Victorian Ambulatory Care Sensitive Conditions Study, 2001-022004, Melbourne: Public Health Rural and Regional Health and Aged Care Services Division. Victorian Government Department of Human Services. Available: http://www.health.vic.gov.au/healthstatus/acsc/index.htm

Wagner, E.H., et al., Improving Chronic Illness Care: Translating Evidence Into Action. Health Aff, 2001. 20(6): p. 64-78.

Wong, S.Y., et al., Comparison of primary care experiences among adults in general outpatient clinics and private general practice clinics in Hong Kong. BMC public health, 2010. 10: p. 397.

World Health Organization, Global status report on noncommunicable diseases2010, Geneva: World Health Organization.

World Health Organization, Primary Health Care: Now More Than Ever: World Health Report 20082008, Geneva: World Health Organization.

World Health Organization, WHO Report on the Global Tobacco Epidemic2009, Geneva: World Health Organization.

Yuen, E.J., Severity of illness and ambulatory care-sensitive conditions. Med Care Res Rev, 2004. 61(3): p. 376-91.