Considering the Impacts of Health Disparities, Inequalities, and Inequities on Early Diagnosis of Pulmonary Arterial Hypertension

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"*Of all the forms of inequality, injustice in health care is the most shocking and inhumane*." – Dr. Martin Luther King, Jr.

Early recognition, diagnosis, and treatment of pulmonary arterial hypertension (PAH) is a worthwhile endeavor in that it remains underdiagnosed in an era where 9 FDA-approved treatments are available, which have shown to provide clinical improvements and prolonged survival.[1] Furthermore, despite the significant advances in understanding the etiology of PAH, the time from onset of symptoms to recognition of the disease has not improved over the past 2 decades, the delay of which results in progression of pathologic changes that are life threatening and irreversible when left untreated. This is particularly concerning in that the potential for optimal clinical outcomes and survival is diminished even after a 2-year delay in diagnosis.[2] The aim of this article is to evaluate the current public health framework to highlight social determinants that influence and may result in barriers in achieving optimal health outcomes, with a focus on factors that may contribute to delayed diagnosis of PAH.[3]

OVERVIEW OF SOCIAL DETERMINANTS OF HEALTH AND HEALTH DISPARITIES IN THE US

Although there have been significant improvements in the health of US residents overall in the past several decades, disparities by race and ethnicity, income and education, gender, disability status, and other social characteristics remain persistent and widely documented.[3] The burden of health care disparities in the US results in an estimated difference of 33 years between the longest and shortest living groups,[4] and ". . . the combined costs of health inequalities and premature death in the US were $1.24 trillion" between 2003-2006.[5] Further, improvement is lagging in the majority of core measures for all priority groups.[6] In most cases, the number of measures of quality and access where disparities exist remained unchanged or in some cases grew larger between 2002-2003 and 2007-2008. Thus, there is much work to be done to reduce health disparities and the need for equity in health outcomes has been recognized as a national priority.

How the terms health disparities, inequalities, or inequities are defined has practical implications for the types of data that are collected and which indicators are monitored by government agencies.[7] The US Department of Health and Human Services (HHS) and Centers for Disease Control and Prevention (CDC) define health disparities as, ". . . differences in health outcomes and their determinants between segments of the population, as defined by social, demographic, environmental, and geographic attributes."[8] Although sometimes used interchangeably with health disparities, the CDC distinguishes health inequalities as ". . .summary measures of population health associated with individual- or group-specific attributes (eg, income, education, or race/ethnicity),"[9] and health inequities as a ". . . subset of health inequalities that are modifiable, associated with social disadvantage, and considered ethically unfair."[10] Because the most severe disparities in US health outcomes are divided along racial and ethnic lines and inextricably tied to social disadvantage, discrimination, exclusion, and geographic segregation, these factors are highlighted in this article.

The Importance of Race/Ethnicity, Socioeconomic Position, and Discrimination on Health

Racial and ethnic minorities are disadvantaged in a variety of ways relevant to health, including: (1) general health status characterized by higher rates of chronic/disabling illness;[11,12] (2) lower likelihood of having health insurance;[13] (3) linguistic barriers between the provider and patient; (4) racial attitudes and discrimination; (5) historical experiences, such as migration and segregation; and (6) reduced likelihood of having a "usual" provider or source of care in the settings where minorities receive health care,[14] resulting in both African Americans and Latinos reporting higher rates of delaying necessary care than Caucasians.[6] In fact, the 2003 Institute of Medicine report *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care* noted that it is the lack of health insurance more than any other factor that negatively influences the quality of health care received by racial and ethnic minorities.[14] Compared to insured Americans, the uninsured are diagnosed at later stages of diseases and receive less treatment.[15]

Previous studies have noted the clustering of social risk factors such as low education attainment, low-wage jobs, and living in poverty, which result in reduced levels of health and health care access.[16-19] In fact, one of the strongest and most consistent predictors of health noted in the literature is socioeconomic position (SEP).[20] Most commonly SEP indicators are defined as education, occupation, income, and assets or wealth.[21] House and others (2000) explained that

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SEP ". . . shapes people's experience of and exposure to virtually all psychosocial and environmental risk factors and that these operate through a range of physiological mechanisms." For example, there are long-term impacts of intrauterine and early childhood environmental factors,[22] and individuals in lower socioeconomic groups are disadvantaged through a variety of biomedical, environmental, psychological, and behavioral factors and the damaging effects of poverty are not easily reversed. One study noted that one period of economic hardship in 1965 was a significant predictor of reduced physical, psychological, and cognitive functioning in 1994.[23]

It is difficult to delineate SEP effects on health separate from those of race/ethnicity in that there are extreme racial differences in education availability, income returns at a given level of education or occupation, income purchasing power, stability of employment, and occupational health risks,[24,25] and marked racial differences in wealth are evident at every income level. Further complexity is added by the fact that there are determinants of racial/ethnic health inequities that are not accounted for by SEP, health risk behaviors, or health care access factors, but are instead likely the result of racial/ethnic discrimination.[14,26] Experiences of racism and, more specifically, individual perceptions of these experiences, have been shown to result in personal negative emotional and stress responses, which in turn have been associated with hypertension, cardiovascular disease, mental health, and other negative states of health.[27-29] Racial/ethnic discrimination can result in limited access to health care, economic deprivation, and inequitable exposures to occupational and environmental hazards[30]—all of which have deleterious effects on health.

Recent efforts to further identify and understand root causes for health disparities in key health outcomes at the national level have also highlighted the role of place as a key determinant of health. These investigations note that it is the geographic segregation of racial/ethnic minorities into low-income urban environments with unique health risk factors, depleted resources, and poor access to health care that accounts for a large proportion of the observed disparities in health. In fact, in one investigation disparities in hypertension, diabetes, obesity among women, and use of health services observed between Caucasians and African Americans at the national level substantially narrowed within a racially integrated, low-income neighborhood in Southwest Baltimore, Maryland.[31]

EVIDENCE OF HEALTH DISPARITIES, INEQUALITIES, AND INEQUITIES AMONG PAH PATIENTS

Poor Access to High-Quality Health Care

Studies demonstrate disparities in specialist consultations for cardiovascular diseases by gender, race, and site of primary care.[32] Primary care physicians report they have more difficulty identifying specialists willing to accept referrals for minority patients who are often uninsured or underinsured.[33] Furthermore, African American-treating physicians are less likely to be board certified, more likely to practice in low-income neighborhoods, and less able to provide high-quality care, including access to subspecialists, diagnostic imaging, and nonemergency hospital admission.[34] Studies also indicate that new therapies tend to be integrated into African American communities at slower rates compared to Caucasian communities, and that African Americans are less likely to be transferred from hospitals that are poorly equipped to handle cardiovascular care.[33] Infrequent doctor visits, less aggressive treatment of respiratory infections, and less availability of pulmonary rehabilitation programs may hamper the survival of minority patients with pulmonary-related diseases,[34] and poor access to subspecialists may prevent timely and accurate diagnosis, ideal care, and avoidance of harmful and ineffective therapies.[35]

In the case of PAH, there is no conclusive evidence demonstrating that racial/ethnic minority patients are identified later in their disease course.[36] In fact, in a recent investigation using data from the Registry to Evaluate Early and Long-term PAH Disease Management (REVEAL), significant associations between delayed diagnosis and race/ethnicity and US geographic region (as determined by a 4-region grouping of residential zip codes: Northeast, Midwest, South, and West) were not detected.[2] Although the racial/ethnic characteristics of REVEAL enrollees match population estimates derived from the US Census Bureau data,[37] the lack of association between race/ethnicity and delay in diagnosis is surprising in the contexts of the disparities in health care access and outcomes among the US population.[6] One possible explanation is that the racial/ethnic minority patients included in the REVEAL study, who are those referred to and treated within specialty PH centers, may not be representative of other minority or lower socioeconomic and geographically segregated patients who have less access to general medical care and may remain undiagnosed and untreated.

Although all Americans are encouraged to practice routine, preventive care designed to assist with early identification of any condition or disease, the link between translating this sound public health message into reasonable courses of action is missing within sizable segments of the population that do not receive employer-sponsored health insurance and cannot afford the expense of health insurance on the individual market. Additionally, access to the care that is needed is often not obtainable even among those who have health insurance due to high out-of-pocket costs (deductibles, copayments, and coinsurance), exclusionary practices (for basic benefits: capped lifetime benefits, preexisting conditions, and medications), higher premium rates or cost sharing for tests and treatment, and outright denial of coverage,[38] and this is particularly true for women. Discriminatory practices targeting women include routinely charging women more for the same coverage men receive, even for policies that do not include maternity care.[39-41] These discriminatory practices and blocking functions are especially pertinent to the PH community because the prevalence and risk of death from PAH is higher among women,[42] and because approved diagnostic procedures and treatments for PAH are

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extremely expensive, administered long term, have serious side effects that mandate close follow-up, and thus receive heightened scrutiny for reimbursement. Consequently, significant administrative burdens are imposed on doctors and patients, and patients are often discouraged or delayed from receiving necessary care.

Worse Health Outcomes and Survival Rates

Racial and ethnic minorities have worse outcomes and survival rates for many conditions, including: cardiovascular disease, asthma, diabetes, influenza, infant mortality, cancer, HIV/AIDS, chronic lower respiratory diseases, viral hepatitis, chronic liver disease and cirrhosis, kidney disease, injury deaths, violence, behavioral health, and oral health.[3] Further, lower lung transplant survival rates and listing rates,[35,43] worse lung cancer outcomes,[36,44,45] and increased asthma mortality have all been documented among racial/ethnic minority patients,[46] as have chronic obstructive pulmonary disease (COPD) outcomes by socioeconomic status.[47]

Several investigators have explored the issue of racial/ethnic and socioeconomic health disparities related to clinical outcomes and survival among PH patients, and some have found minority racial/ethnic status to be predictive of worse survival rates.[36,42] However, varied versions of disease classification systems have been used, some occurring prior to the 2003 revised classification system for PH,[42,48] and only some have included clinical data.[36] For example, using National Vital Statistic System (NVSS) and hospital discharge data from the National Hospital Discharge Survey (NHDS) from 1980-2002 and Medicare hospital claims data for 1990-2002, the CDC reported that higher age-standardized death rates and Medicare hospitalization rates for pulmonary hypertension were observed for African Americans when compared to Caucasians, while the lowest rates were observed among Hispanics.[49] This examination included a full complement of diagnostic codes having any relationship to all types of pulmonary hypertension, and the findings are therefore not necessarily comparable to other investigations.[50]

Delineating socially constructed, potentially malleable racial/ethnic differences in PAH treatment and outcomes is complicated given there are genetic and serologic characteristics unique to African Americans, increasing their susceptibility to disease states associated with PAH such as systemic sclerosis (SSc) and sickle cell disease. For example, although studies have shown that African Americans have a significantly increased incidence of diffuse scleroderma, disease manifestation at a younger age, greater likelihood of developing aggressive scleroderma, and significantly worse prognosis after adjusting for age at diagnosis compared to Caucasians,[51] these differences have largely, but not entirely, been attributed to differences in SSc-associated autoantibodies. In fact, differences in severity of pulmonary fibrosis and severe gastrointestinal disease were observed between African Americans and Caucasians who share the same antibody subset, with African Americans faring worse on these outcomes.[52]

With respect to sickle cell disease, approximately 1 out of every 500 African Americans and 1 out of every 36,000 Hispanic Americans are born with sickle cell disease, and 1 in 12 African Americans have the sickle cell trait.[53] Pulmonary complications, including PAH, account for a large portion of deaths among patients with sickle cell disease. However, some of the causes of PAH are reversible, such as hypoxemia, thromboembolism, and asthma. Thus, it has been recommended that patients with sickle cell disease should be routinely screened for PAH.[54]

African Americans are also at increased risk for other conditions that are known to be risk factors for PAH, including HIV[55] and liver disease.[56] Other conditions that may explain racial differences are higher rates of risk factors for metabolic syndrome and markers of systemic diseases such as sleep-disordered breathing, asthma, obesity, and systemic hypertension.[42] One of the clearest examples of health inequity in US history is the toll that HIV/AIDS has taken on African Americans, with young African American gay and bisexual men bearing the greatest proportion of this burden. In 2009, African Americans comprised 14% of the US population but accounted for 44% of all new HIV infections.[55] Though the prevalence of HIV-associated PAH has remained at 0.5% before and after the introduction of antiretroviral therapy,[57] the incidence appears to be increasing as antiretroviral therapy prolongs survival in patients with HIV. Thus, it is likely that African Americans will be differentially impacted by HIV-associated PAH.

Finally, racial/ethnic minority women are particularly disadvantaged when considering cardiovascular care and outcomes in both general cardiac measures, as well as PAH specifically. For example, although women comprise nearly 50% of the patients hospitalized for heart failure, they are often underrepresented in many major clinical heart failure trials.[58,59] Further, although PAH is more prevalent among Caucasian women and women of all racial/ethnic groups have higher mortality rates resulting from PAH,[42] African American women are at increased risk for death resulting from PAH compared to any other group. This demonstrates a significant health disparity given African American men have higher age-adjusted mortality rates and worse health outcomes compared to African American women.[36,42]

CONCLUSION

The evidence presented in this article suggests that further exploration of the relationships between race/ethnicity, gender, SEP, and geographic place, with time to diagnosis, clinical outcomes, and survival rates among all patients with PAH is warranted. Although biological differences may account for a portion of the relatively poorer outcomes observed among racial/ethnic minority PAH patients, it is likely that an additional unmeasured portion results from inequities in environment, social interactions, economic resources, and access to preventive and specialty medical care—all of which have the potential to result in poorer overall health and delayed recognition of PAH. Although others have explored these issues with the data presently available, it is likely that improvements could be made to the indicators collected to describe socioeconomic conditions in particular. Without these data, it

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is difficult to evaluate the true impact of observed disparities attributable to SEP, and the complexity of the interaction between race/ethnicity and SEP. Further, consistency in how social characteristics and PAH diagnostic criteria are described across studies would allow for evaluation of trends over time.

Should careful examination reveal that access to health care and delayed diagnosis do not account for the relatively poor prognosis among minority PAH patients, additional qualitative research may be helpful to further elucidate the ways in which one may be exposed to social and environmental factors that may trigger or exacerbate one's genetic predisposition for PAH, and the reasons why only a small portion of individuals with PAH-associated disorders and conditions such as congenital heart malformations, collagen vascular diseases, or HIV develop PAH.[60] Perhaps an overall compromised state of health makes it less possible to benefit from available treatments and cope with the disease over time, and working to eliminate the predisposing factors may provide promising results for some patients. Although posed at the individual level, these questions should be constructed with an eye toward exacting strategies for eliminating broader, structural inequities within our health care delivery system.

Although the ultimate and just goal is equal access and quality of medical care for all, in fact, all patients presenting with PAH-related symptoms should not be treated the same, as their life conditions, exposures, and access to health care have been subject to social and structural injustices known to deteriorate health.[14,26] For some racial/ethnic minority patients and patients of lower SEP, questions about how long one has experienced any given symptom will be evaluated in the context of, and biased by, other perhaps more demanding and debilitating symptoms. Furthermore, for one who has experienced years of poor health with little medical intervention, recalling specifics such as date of onset and other related symptoms may be especially challenging. This then raises questions about the comparability and reliability of current measures that are used to assess delay in diagnosis across population groups.

Further, it is important to note that the relationships in question may change over time. Of particular interest will be the pattern of PAH diagnosis and prognosis within the growing numbers of Hispanic Americans—a population segment projected to rise from 14% (in 2005) to 29% by 2050.[61] Although studies to date have noted Hispanic ethnicity is protective for PAH-related outcomes when compared to other groups,[49] this pattern may change over time as negative health effects associated with acculturation may impact growing numbers of Hispanic Americans living with PAH, particularly if this ethnic group continues to experience its present rates of relatively higher uninsurance.[12]

While PAH-treating physicians undoubtedly work to provide each individual patient with the best medical care available, it is imperative to assure that these benefits are not segregated within the US based on social advantage. One attempt to evaluate the equity of access to PAH diagnosis and care may be to assess whether or not the patients enrolled in present registries and clinical trials are representative of all patients, particularly those who are typically disadvantaged with respect to health care access and outcomes. This approach would encourage more rigorous screening of potentially "at-risk" patients (as identified by both demographic and clinical characteristics known to be associated with PAH) within primary care and community-based settings and may point to potential strategies that further engage community clinics and health centers (CCHCs). CCHCs have long served an important safety-net health care delivery role for vulnerable populations. Since the mid-1960s, health centers have provided primary care services at low or no cost to individuals living in medically underserved areas, and recent strategies for eliminating health disparities have included increasing the capacities of CCHCs across the country.[62]

In theory, it seems reasonable to expect that if all health care inequities were eliminated, the pathway to diagnosis would be shortened to some degree for those patients who are differentially burdened by these inequities. However, this assertion has yet to be empirically proven for PAH. Thus, identifying and measuring all aspects of health disparities, inequities, and inequalities between PAH patients from more and less advantaged social groups would more than merely quantify and describe the problem. Instead, distinguishing between those differences that are biological (or otherwise nonmodifiable) and those that are socially and environmentally construed (and can be potentially addressed and eliminated) is a useful endeavor. Understanding the complete spectrum of contributing factors and the full burden of PAH will only enhance future patient care, population-level and clinical research, and national efforts to promote health equity.

References

1. Lourenço AP, Fontoura D, Henriques-Coelho T, Leite-Moreira AF. Current pathophysiological concepts and management of pulmonary hypertension. *Int J Cardiol*. 2012;155(3):350-361.
2. Brown LM, Chen H, Halpern S, et al. Delay in recognition of pulmonary arterial hypertension: factors identified from the REVEAL Registry. *Chest*. 2011;140(1):19-26.
3. HHS Action Plan to Reduce Racial and Ethnic Health Disparities. A nation free of disparities in health and health care. Department of Health and Human Services; 2011.
4. Murray CJ, Kulkarni SC, Michaud C, et al. Eight Americas: investigating mortality disparities across races, counties, and race-counties in the United States. *PLoS Med*. 2006;3(9):e260.
5. Andrulis DP, Siddiqui NJ, Purtle J, Duchon L. Patient protection and affordable care act of 2010: advancing health equity for racially and ethnically diverse populations. Washington, DC: Joint Center for Polictical and Economic Studies; 2010.
6. U.S. Department of Health and Human Services Agency for Healthcare Research and Quality. National Healthcare Disparities Report: U.S. Department of Health and Human Services; 2011. Report No.: 12-0006.
7. Braveman P. Health disparities and health equity: concepts and measurement. *Annu Rev Public Health*. 2006;27:167-194.
8. Carter-Pokras O, Baquet C. What is a "health disparity"? *Public Health Rep*. 2002;117(5):426-434.
9. Asada Y. A summary measure of health inequalities for a pay-for-population health performance system. *Prev Chronic Dis*. 2010;7(4):A72.
10. Braveman P, Gruskin S. Defining equity in health. *J Epidemiol Community Health*. 2003;57(4): 254-258.
11. National Healthcare Disparities Report (NHDR). 2007. http://www.ahrq.gov/qual/nhdr07/Key.htm. Accessed March 7, 2009.
12. Centers for Disease Control and Prevention. Health Disparities and Inequalities Report - United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services 2011.

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13. Brown ER, Lavarreda SA, Ponce N, Yoon J, Cummings J, Rice T. The State of Health Insurance in California: Findings from the 2005 California Health Interview Survey. Los Angeles, CA: UCLA Center for Health Policy Research; 2007.
14. Smedley B, Stith A, Nelson AL. Unequal Treatment: Confronting Racial and Ethinic Disparities in Health Care. Washington, DC: Committee on Understanding and Eliminating Racial Disparities in Health Care, Institute of Medicine, National Academies Press; 2003.
15. Richardson LD, Norris M. Access to health and health care: how race and ethnicity matter. *Mt Sinai J Med*. 2010;77(2):166-177.
16. D'Anna LH, Ponce NA, Siegel JM. Racial and ethnic health disparities: evidence of discrimination's effects across the SEP spectrum. *Ethn Health*. 2010;15(2):121-143.
17. Aday L. At Risk in America: The Health and Health Care Needs of Vulnerable Populations in the United States. 2nd ed. San Francisco, CA: Jossey-Bass; 2001.
18. Shi L, Stevens GD. Vulnerable Populations in the United States. San Francisco, CA: Jossey-Bass; 2005.
19. Stevens GD, Seid M, Mistry R, Halfon N. Disparities in primary care for vulnerable children: the influence of multiple risk factors. *Health Serv Res*. 2006;41(2):507-531.
20. Williams DR. Race and health: basic questions, emerging directions. Ann Epidemiol. 1997; 7(5):322-333.
21. House JS, Williams DR. Understanding and reducing socioeconomic and racial/ethnic disparities in health. In: Smedley B, Syme SL, eds. Promoting Health: Intervention Strategies from Social and Behavioral Research. Washington, DC: National Academy Press; 2000.
22. Smith DB. Health care divided: race and healing a nation. Ann Arbor, MI: University of Michigan Press; 1999.
23. Lynch JW, Kaplan GA, Salonen JT. Why do poor people behave poorly? Variation in adult health behaviours and psychosocial characteristics by stages of the socioeconomic lifecourse. *Soc Sci Med*. 1997;44(6):809-819.
24. Kaufman JS, Cooper RS, McGee DL. Socioeconomic status and health in blacks and whites: the problem of residual confounding and the resiliency of race. *Epidemiology*. 1997;8(6):621-628.
25. Williams DR, Collins C. U.S. socioeconomic status and health in blacks and whites: the problem of residual confounding and the resiliency of race. *Epidemiology*. 1995;8:621-628.
26. James SA. Confronting the moral economy of the US racial/ethnic health disparities. *Am J Public Health*. 2003;93(2):189.
27. Eisenberger NI, Lieberman MD, Williams KD. Does rejection hurt? An FMRI study of social exclusion. *Science*. 2003;302(5643):290-292.
28. Karlsen S, Nazroo JY. Relation between racial discrimination, social class, and health among ethnic minority groups. *Am J Public Health*. 2002;92(4): 624-631.
29. Williams DR. Race, socioeconomic status, and health. The added effects of racism and discrimination. *Ann N Y Acad Sci*. 1999;896:173-188.
30. Cain VS, Kington RS. Investigating the role of racial/ethnic bias in health outcomes. *Am J Public Health*. 2003;93(2):191-192.
31. Laveist T, Pollack K, Thorpe R Jr, Fesahazion R, Gaskin D. Place, not race: disparities dissipate in southwest Baltimore when blacks and whites live under similar conditions. *Health Aff (Millwood)*. 2011;30(10):1880-1887.
32. Cook NL, Ayanian JZ, Orav EJ, Hicks LS. Differences in specialist consultations for cardiovascular disease by race, ethnicity, gender, insurance status, and site of primary care. *Circulation*. 2009; 119(18):2463-2470.
33. Savitz ST. Literature-Based Appraisal of Racial/Ethnic Cardiovascular Health Care Disparities. International Scholarly Research Network Public Health 2012.
34. Bach PB, Pham HH, Schrag D, Tate RC, Hargraves JL. Primary care physicians who treat blacks and whites. *N Engl J Med*. 2004;351(6):575-584.
35. Lederer DJ, Benn EK, Barr RG, et al. Racial differences in waiting list outcomes in chronic obstructive pulmonary disease. *Am J Respir Crit Care Med*. 2008;177(4):450-454.
36. Kawut SM, Horn EM, Berekashvili KK, et al. New predictors of outcome in idiopathic pulmonary arterial hypertension. *Am J Cardiol*. 2005;95(2):199-203.
37. Frost AE, Badesch DB, Barst RJ, et al. The changing picture of patients with pulmonary arterial hypertension in the United States: how REVEAL differs from historic and non-US Contemporary Registries. *Chest*. 2011;139(1):128-137.
38. Blumberg LJ, Holahan J. The individual mandate–an affordable and fair approach to achieving universal coverage. *N Engl J Med*. 2009;361(1):6-7.
39. Peacock AJ, Naeije R, Galiè N, Rubin L. Endpoints and clinical trial design in pulmonary arterial hypertension: have we made progress? *Eur Respir J*. 2009;34(1):231-242.
40. Ghofrani HA, Wilkins MW, Rich S. Uncertainties in the diagnosis and treatment of pulmonary arterial hypertension. *Circulation*. 2008;118(11): 1195-1201.
41. Mukherjee B, Howard L. Combination therapy in pulmonary arterial hypertension: do we have the right strategy? *Expert Rev Respir Med*. 2011;5(2): 191-205.
42. Davis AM, Vinci LM, Okwuosa TM, Chase AR, Huang ES. Cardiovascular health disparities: a systematic review of health care interventions. *Med Care Res Rev*. 2007;64(5 Suppl):29S–100S.
43. Liu D, Huang Y, Zeng J, et al. Down-regulation of JAK1 by RNA interference inhibits growth of the lung cancer cell line A549 and interferes with the PI3K/mTOR pathway. *J Cancer Res Clin Oncol*. 2011;137(11):1629-1640.
44. Gadgeel SM, Severson RK, Kau Y, Graff J, Weiss LK, Kalemkerian GP. Impact of race in lung cancer: analysis of temporal trends from a surveillance, epidemiology, and end results database. *Chest*. 2001;120(1):55-63.
45. Wisnivesky JP, McGinn T, Henschke C, Hebert P, Iannuzzi MC, Halm EA. Ethnic disparities in the treatment of stage I non-small cell lung cancer. *Am J Respir Crit Care Med*. 2005;171(10):1158-1163.
46. Grant EN, Lyttle CS, Weiss KB. The relation of socioeconomic factors and racial/ethnic differences in US asthma mortality. *Am J Public Health*. 2000;90(12):1923-1925.
47. Eisner MD, Blanc PD, Omachi TA, et al. Socioeconomic status, race and COPD health outcomes. *J Epidemiol Community Health*. 2011;65(1):26-34.
48. Simonneau G, Galiè N, Rubin LJ, et al. Clinical classification of pulmonary hypertension. *J Am Coll Cardiol*. 2004;43(12 Suppl S):5S–12S.
49. Hyduk A, Croft JB, Ayala C, Zheng K, Zheng ZJ, Mensah GA. Pulmonary hypertension surveillance–United States, 1980-2002. *MMWR Surveill Summ*. 2005;54(5):1-28.
50. Link J, Glazer C, Torres F, Chin K. International Classification of Diseases coding changes lead to profound declines in reported idiopathic pulmonary arterial hypertension mortality and hospitalizations: implications for database studies. *Chest*. 2011; 139(3):497-504.
51. Laing TJ, Gillespie BW, Toth MB, et al. Racial differences in scleroderma among women in Michigan. *Arthritis Rheum*. 1997;40(4):734-742.
52. Steen V, Domsic RT, Lucas M, Fertig N, Medsger TA. A clinical and serologic comparison of African-American and Caucasian patients with systemic sclerosis. *Arthritis Rheum*. 2012 May 10. [Epub ahead of print]
53. Who is at risk for sickle cell anemia? http://www.nhlbi.nih.gov/health/health-topics/topics/sca/atrisk.html.
54. Minter KR, Gladwin MT. Pulmonary complications of sickle cell anemia. A need for increased recognition, treatment, and research. *Am J Respir Crit Care Med*. 2001;164(11):2016-2019.
55. Centers for Disease Control and Prevention. Estimates of New HIV Infections in the United States, 2006-2009. Atlanta, GA: Centers for Disease Control and Prevention; 2011.
56. Nguyen GC, Thuluvath PJ. Racial disparity in liver disease: Biological, cultural, or socioeconomic factors. *Hepatology*. 2008;47(3):1058-1066.
57. Sitbon O, Lascoux-Combe C, Delfraissy JF, et al. Prevalence of HIV-related pulmonary arterial hypertension in the current antiretroviral therapy era. *Am J Respir Crit Care Med*. 2008;177(1):108-113.
58. Shin JJ, Hamad E, Murthy S, Piña IL. Heart failure in women. *Clin Cardiol*. 2012;35(3):172-177.
59. Chandrasekaran SA, Ventura HO, Lavie CJ, Pina I. Disparities in women with heart failure. *Curr Cardiovasc Risk Rep*. 2011;5(3)261-265.
60. Taraseviciute A, Voelkel NF. Severe pulmonary hypertension in postmenopausal obese women. *Eur J Med Res*. 2006;11:198-202.
61. U.S. Population Projections: 2005-2009. Pew Research Center, 2008. http://www.pewhispanic.org/2008/02/11/us-population-projections-2005-2050/.
62. The Vital Role of Community Clinics and Health Centers: Assuring Access for All Americans. California Primary Care Association, 2008. www.cpca.org/about/documents/vitalrole.pdf. Accessed September 2008.

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