Gender differences in biological markers in the US, Taiwan, and Japan
Extended Abstract

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Introduction

Currently, females in all countries of the world experience lower mortality and longer life expectancy than males (Barford et al., 2006). This has been true in most countries with relatively low mortality (Gjonca, Tomassi, Vaupel, 1999; Kinsella & Gist, 1998; Murray & Lopez, 1996; Nathanson, 1984). However, in the United States (US) and several other countries, the gender gap in mortality has recently been shrinking. Men have been improving faster than women, thus indicating that male-female differences are linked to social, behavioral, and economic changes (Crimmins, 2004).

Within populations, one of the first signs of deteriorating health is the onset of high risk biological markers. While several studies have conducted inter and intra-country comparisons of biological markers (Banks et al., 2006; Crimmins et al., 2008; Goldman et al., 2006; Kim et al., 2006; Turra et al., 2005), only a few have examined the inter-country differences by gender (Goldman et al., 2004). In this paper, we compare biological markers in the US and Taiwan, a country rapidly undergoing modernization, by gender in order to better understand the paths to differential life expectancy between males and females. When biomarkers become available in the next few months, we plan to include Japan in this cross-national comparison.

Methods

Cross-country comparisons of biomarker data are derived from the fourth wave of the National Health and Nutrition Examination Surveys (NHANES) for the US and the Social Environment and Biomarkers of Aging Study (SEBAS) for Taiwanese respondents. Collected between 1999 and 2002, NHANES IV is a nationally representative, cross-sectional survey of the U.S. population. NHANES utilizes a multistage probability design that oversamples for Blacks, Hispanic Americans (primarily of Mexican descent), and people age 60 and older. This yearly survey employs extensive interviews and medical examinations, including laboratory tests, to provide a comprehensive analysis of the health and nutrition status of US adults and children. The implementation of sample weights ensures that the sample is representative of the non-institutionalized U.S. population.

Similarly, detailed interviews and laboratory data were collected from a nationally representative sample (excluding the aboriginal population) of Taiwanese older adults in the 2000 wave of the SEBAS. Originating as a randomly selected subsample of the Survey of Health and Living Status of the Near Elderly and Elderly in Taiwan, SEBAS consists of both in-home interviews and, where possible, hospital-based physical examinations. SEBAS oversamples for urban residents and respondents age 71 and older.

We examined the age-sex patterns of 8 commonly studied biomarkers found in each survey. These biomarkers included: systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol, glycated hemoglobin (HbA_{1c}), triglycerides, high-density lipoprotein (HDL) cholesterol, body mass index (BMI), and albumin. Age is categorized into four groups: ages 54-59, 60-69, 70-79, and 80 and older. Figures 1-8 illustrate gender differences by age group for each indicator.

Results

Gender differences in blood pressure are apparent both within and between the US and Taiwan. US males have significantly lower SBP from ages 54-79 compared to Taiwanese males (Figure 1). On the other hand, there is no significant difference among females in the two countries. With increasing age, males and females in both countries exhibited increasing SBP. For all ages investigated, DBP is significantly lower in the US for both genders compared to Taiwan (Figure 2). In the US, females age 60-69 have significantly lower DBP than US males.

Figure 3 shows that Americans are heavier than the Taiwanese. The mean BMI is significantly higher for American men and women ages 54 and older compared to their Taiwanese counterparts; however, significant gender differences were only observed for the Taiwanese where females age 70-79 had a higher mean BMI compared to males.

Gender and country differentials were also found for cholesterol levels. For both the US and Taiwan, females generally have higher levels of both total and HDL cholesterol compared to males (Figures 4 and 5, respectively). In the US, females have significantly higher levels of total cholesterol for ages 54 and older while in Taiwan, gender differences were present for ages 60-79 (Figure 4). Moreover, US females have significantly higher mean levels of HDL compared to US males at ages 54 and older whereas Taiwanese males have significantly lower mean HDL levels compared to Taiwanese females only at ages 54-59 (Figure 5).

Americans generally have higher mean triglyceride levels compared to the Taiwanese (Figure 6). Between the two countries, gender differences were found only for Taiwanese individuals age 70-79, with females having higher triglyceride levels than males.

Gender differences in HbA_{1c} were found in Taiwan but not in the US. For ages 60-79, Taiwanese females had higher mean HbA_{1c} levels compared to males (Figure 7). Inter-country differences were apparent for both males and females. For ages 60-79, Taiwanese females had higher HbA_{1c} levels compared to US females; however Taiwanese females had lower HbA_{1c} levels for ages 54-59 compared to US females. Conversely, American men aged 70-79 had higher HbA_{1c} levels compared to Taiwanese males.

While American men and women differed in mean levels of albumin for ages 54 and older, Taiwanese men and women showed no significant differences (Figure 8). Between the two countries, Taiwanese females age 54-79 had higher mean albumin levels compared to US females. However, there was no difference in albumin levels between Taiwanese and American men.

Conclusion

While it is known that the Taiwanese are less heavy and generally more healthy than Americans, other differences emerge when comparing countries by gender. When drawing comparisons by gender, there seems to be greater instances of between country differences than when comparing intra-country differences by gender. Among men, SBP and DBP were higher in Taiwan than in the US; however, Taiwanese men had lower mean BMI and triglycerides compared to American men. For women, only DBP was higher in Taiwan compared to the US, while mean levels of BMI, triglycerides, HDL, HbA_{1c}, and albumin were higher among American women compared to Taiwanese women.

Lastly, in both countries, females generally have higher SBP, total cholesterol, and HDL cholesterol compared to males. This study indicates that gender differences in levels of biomarkers exist both within and between countries. It is probable that these differences are related to environmental factors that may be related to diet, lifestyle, and culture.

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Figures

Figure 1. Mean systolic blood pressure (SBP) by age group in the US and Taiwan

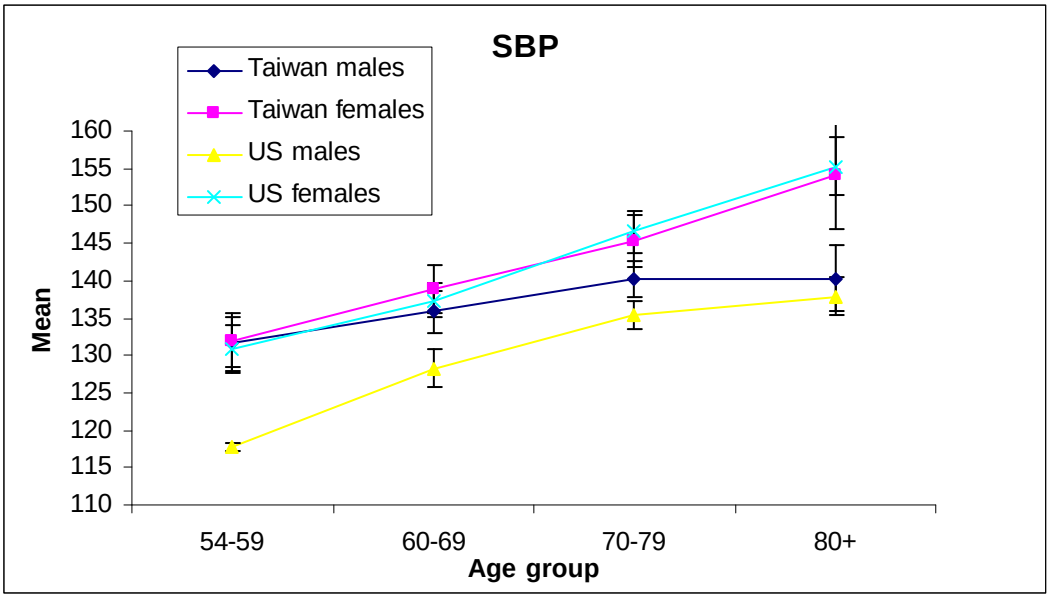

Figure 2. Mean diastolic blood pressure (DBP) by age group in the US and Taiwan

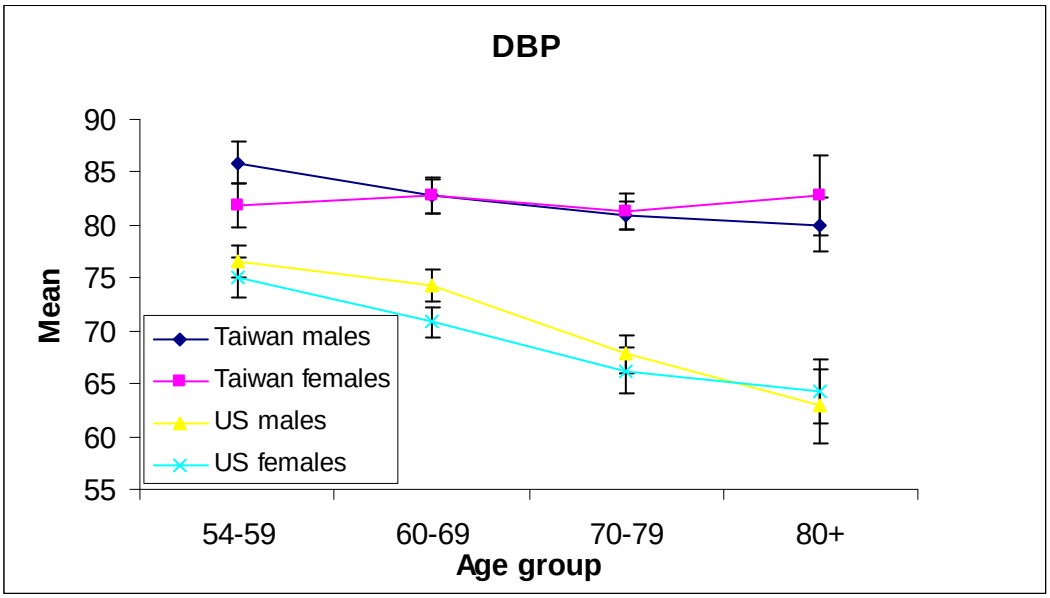

Figure 3. Mean body mass index by age group in the US and Taiwan

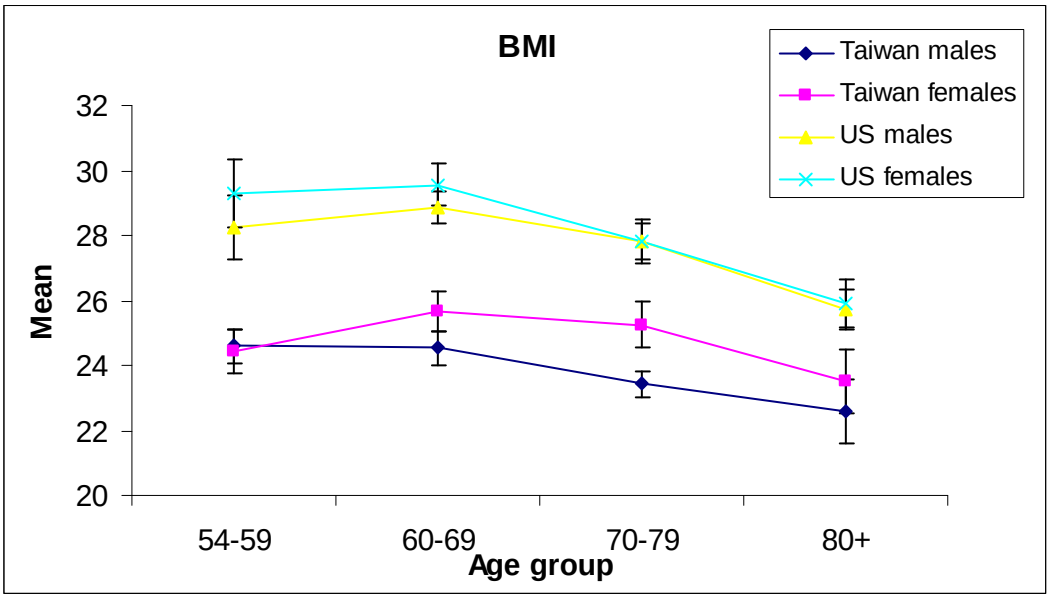

Figure 4. Mean total cholesterol by age group in the US and Taiwan

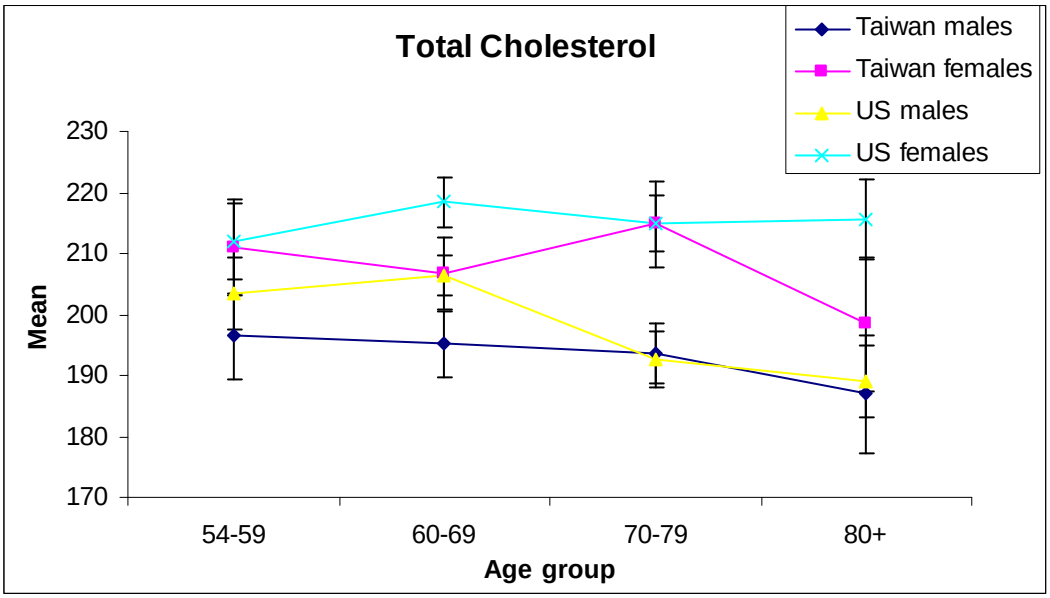

Figure 5. Mean high density lipoprotein (HDL) cholesterol by age group in the US and Taiwan

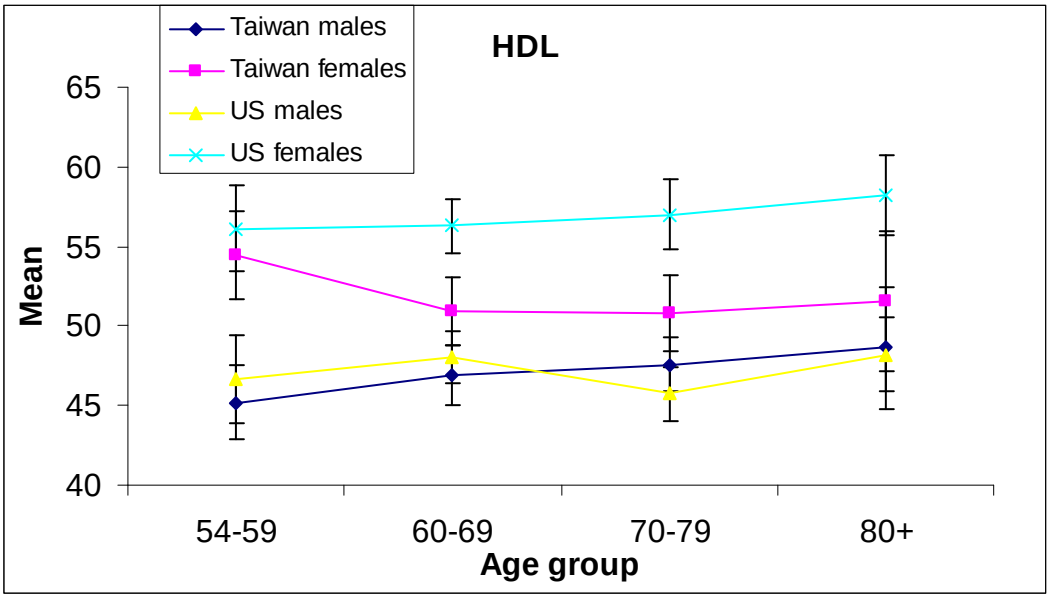

Figure 6. Mean triglycerides by age group in the US and Taiwan

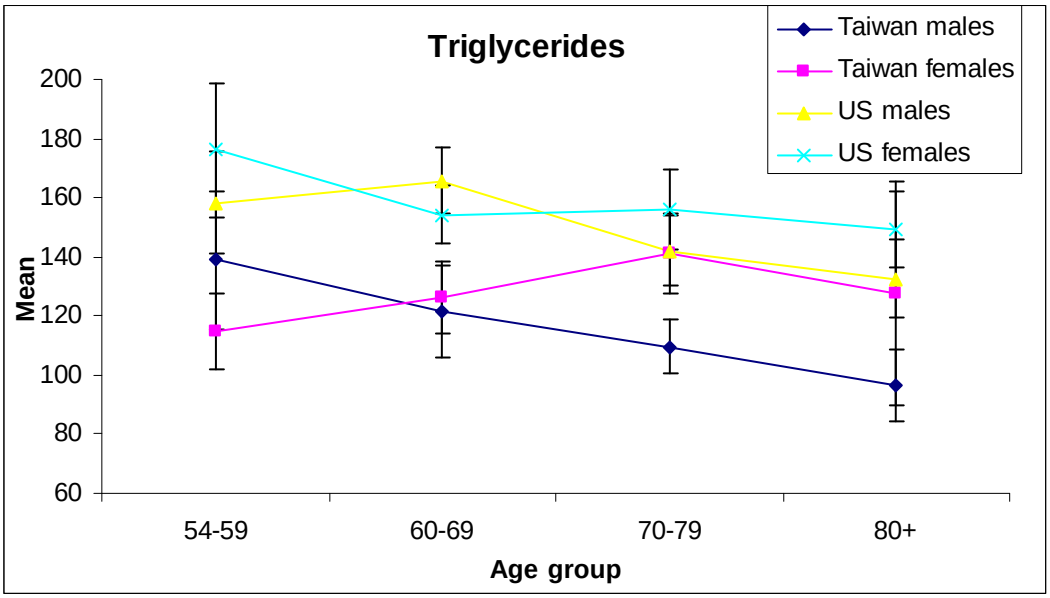

Figure 7. Mean glycated hemoglobin (HbA_{1c}) by age group in the US and Taiwan

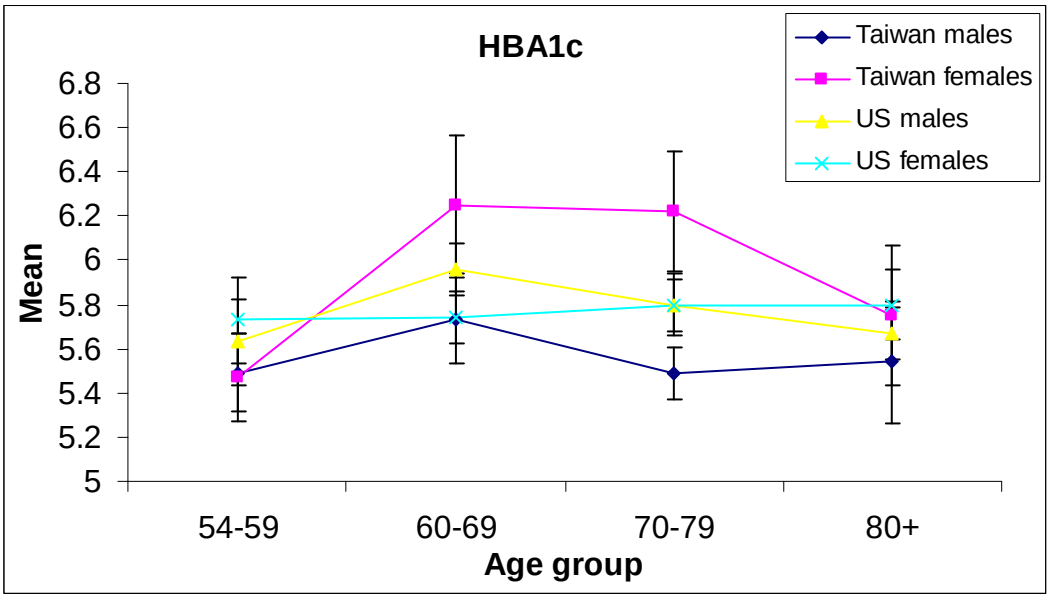

Figure 8. Mean albumin by age group in the US and Taiwan