A Demographic Evaluation of Increasing Rates of Suicide Mortality in Japan and South Korea, 1985-2010

Authors:

Sun Young Jeon
Eric N. Reither

Correspondence:

Sun Young Jeon
Utah State University
Department of SSW&A
0730 Old Main Hill
Logan, UT 84322-0730
phone (435) 764-8819
e-mail s.jeon@aggiemail.usu.edu

BACKGROUND

Suicide is a major health concern and cause of premature mortality. According to a recent World Health Organization report, about one million people die by suicide each year (WHO 2002). Fortunately, rates of suicide mortality have declined among most member states of the Organization for Economic Cooperation and Development (OECD) in recent decades (Figure 1). However, Japan and South Korea are notable exceptions to this trend in OECD nations. In Japan, rates of suicide mortality increased from 14.5 per 100,000 person-years lived (PYL) in 1990 to 19.4 per 100,000 PYL in 2009. Currently, Japan exhibits the second highest rate of suicide among OECD nations. The increase in suicide mortality in South Korea has been even more dramatic. In 1990, the rate of suicide mortality in South Korea was just 7.9 per 100,000 PYL. By 2009, it had climbed to 28.4 per 100,000 PYL, which is the highest among OECD member states. From a population health perspective, it is important to gain a deeper understanding into the determinants responsible for increasing rates of suicide mortality in Japan and South Korea.

THEORETICAL FRAMEWORK

Durkheim (1951) insisted that suicide in a society does not have any obvious relationship to the prevalence of mental disorders. According to Durkheim, international variation in suicide rates does not stem from individual psychological characteristics such as depression, but rather from disturbances to the social equilibrium, such as economic recession or rapid industrial expansion (Leo, 2002). Some scholarship has evaluated the impact of various socio-demographic variables on increasing suicide rates in Japan and South Korea, including economic factors (Yang 1992), as well as rates of divorce (Kim et al. 2011) and marriage (Park and Lester 2006). These studies have detected strong associations between suicide and divorce rates in South Korea (Kim et al. 2011), as well as associations between suicide and economic crises in both Japan and South Korea in the late 1990s (Chang et al. 2009).

A more limited body of work has attempted to isolate these secular changes or period effects from factors related to population aging and birth cohort membership. For instance, Odagiri et al. (2011) found that instead of secular changes, strong age effects among middle-aged men were responsible for increasing suicide rates in Japan. Based on a similar analysis, Lee and Kim (2010) argue that, instead of secular changes in South Korea, strong cohort effects have made the largest contribution to increasing suicide rates (Lee and Kim 2010). Results from these studies make clear the importance of evaluating secular changes in the context of both age- and cohort-related factors that also impact the health of populations.

Our study replicates and extends prior work by investigating the relative importance of age factors, secular changes, and birth cohort membership on rates of suicide mortality in *both* Japan and South Korea, from 1985-2010. Importantly, extant research on suicide mortality in South Korea extends only to the early 2000s – prior to South Korea's rapid increase in suicide rates. Moreover, prior research has generally studied Japan and South Korea in isolation, thereby missing out on the opportunity to compare and contrast the determinants of suicide patterns in these neighboring countries that share many social, economic and demographic characteristics. Through this investigation, we hope to shed light on recent trends in suicide mortality in both nations – and in particular, we aim to develop a better understanding of why South Korea and Japan have diverged over the past decade.

METHODS

Data

Age-Period-Cohort (APC) analyses of suicide morality rates require two types of data: (1) the number of people exposed to the risk of suicide, and (2) the number of suicide deaths. In this study, the population exposed to the risk of suicide is simply the populations of Japan and South Korea, which are divided into age- and sex-specific categories. Japan and South Korea offer population data through their respective national statistics organizations - the Ministry of Internal Affairs and Communications in Japan, and Statistics Korea. Information on suicide mortality is made available by Statistics Korea and the Vital Statistics Survey, which is conducted by the Japanese Ministry of Health, Labor and Welfare.

In this study, population and suicide mortality data were collected for the period 1985 to 2010. Both age categories and periods of observation were divided into five-year intervals. The youngest age groups (0-4 and 5-9) were excluded from our study because suicide rates for these groups are typically zero. Subtracting age from the period of observation derived a variable for birth cohort membership, which was also divided into five-year increments.

Analyses

The Age-Period-Cohort (APC) model has been used to analyze cohort effects when a researcher is also interested in age and period effects (Yang, Fu, and Land 2004). The model is particularly useful in research concerning risk factors for mortality in demography and epidemiology (Hobcraft, menken, and Preston 1982; Robertson, Gandini, and Boyle 1999) because it distinguishes three types of time-related effects. In this study, the APC *Intrinsic Estimator* (IE) model using the STATA APC-IE module was used to estimate suicide rates in Japan and South Korea. Recent studies suggest that the APC-IE model produces valid and reliable estimates of age, period, and cohort effects and that it is a significant step forward from previous APC approaches that are highly sensitive to assumptions embedded within the models (Fu 2000; Yang et al. 2004).

PRELIMINARY RESULTS

Age effects (Figure 2.1) in Japan steadily increased until the middle fifties decreased thereafter. Conversely, in South Korea age effects were relatively low among middle-aged people and were highest among elderly persons aged 80 and over. Period effects (Figure 2.2) in Japan increased between 1995 and 2000, which was a period of economic crisis. Conversely, period effects in South Korea increased most rapidly between 2000 and 2005, several years after the height of the economic crisis. Period effects in South Korea increased throughout the 1990s and 2000s, whereas period effects in Japan largely stabilized after 2000. Japan and South Korea show an opposite patterning of birth cohort effects. In South Korea, cohorts born between the early 1920s and late 1960s have higher rates of suicide than either younger or older birth cohorts – and peak suicide mortality occurred for cohorts born roughly between the Great Depression and the aftermath of World War II (Figure 2.3). In contrast, suicide rates in Japan were highest among the 1905-1909 birth cohort, the eldest population of analysis, and sustained relatively lower levels since the 1925-1929 birth cohort.

DISCUSSION

Despite numerous similarities between Japan and South Korea, our results suggest that increasing suicide rates over the past few decades have fundamentally different causes in these countries. Consistent with prior work, our study shows that age effects account for much of the increase in suicide rates in Japan – as a large segment of the population has aged into the high-risk range of approximately 40-65. Although the economic crisis of the late 1990s and cohort-based influences among the elderly are also important in Japan, they appear to have less influence on overall trends in rates of suicide mortality than age-related factors.

Conversely, in South Korea we observe strong effects for all three dimensions of demographic time. Secular changes in South Korea – including but apparently not limited to the economic crisis of the late 1990s – have led to increasing rates of suicide mortality throughout the 1990s and 2000s. We also observe strong cohort effects in South Korea, particularly for individuals born during the period of upheaval between the Great Depression and the aftermath of World War II – including of course, the Korean War. Finally, we detect that suicide mortality in South Korea begins to increase around retirement age and continues to rise into elderly ages.

Because period and cohort effects in Japan have stabilized at relatively low levels in recent periods of observation and for members of recent birth cohorts, we anticipate that rates of suicide mortality in Japan will moderate in the coming years. In South Korea, however, period effects have been increasing since 1990 and show the highest levels in 2010. Furthermore, both population aging and a broad base of individuals belonging to high-risk birth cohorts will likely contribute to persistently high and perhaps even increasing suicide rates in South Korea.
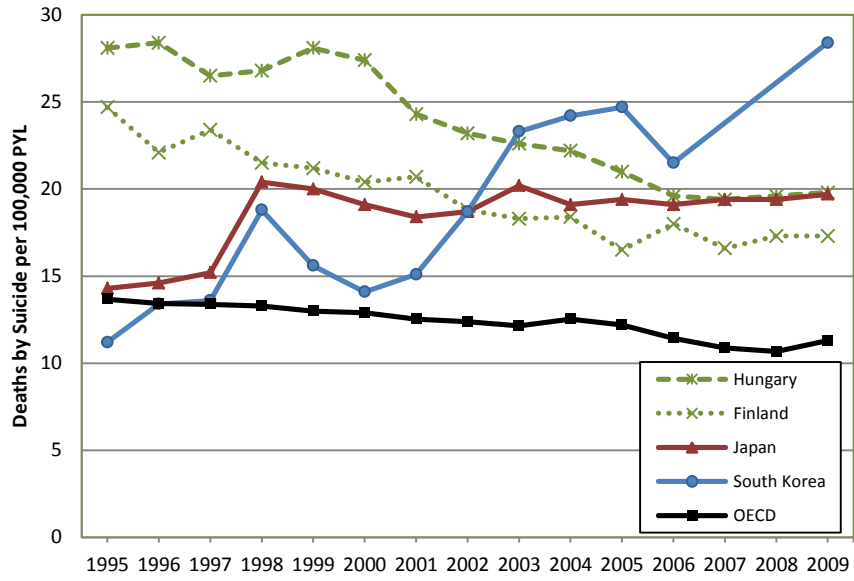
FIGURE1. Deaths by Suicide per 100,000 PYL in Hungary, Finland, Japan and South Korea, 1995-2009, (OECD Health Data, 2011)

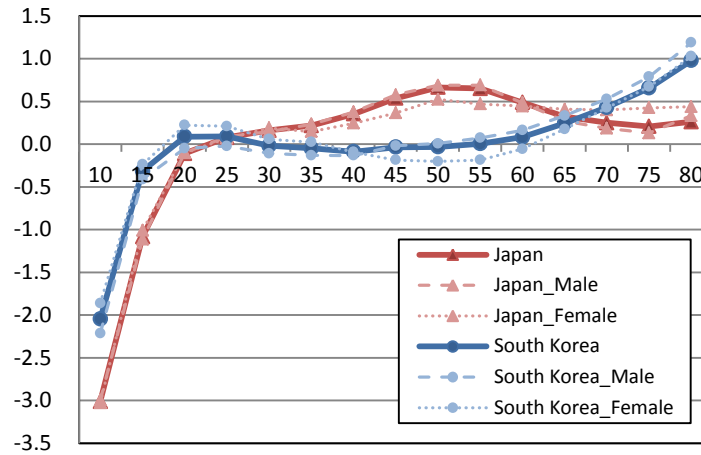**FIGURE 2.1** APC-IE Results: Suicide Mortality, Age Effects

FIGURE 2.2 APC-IE Results: Suicide Mortality, Period Effects
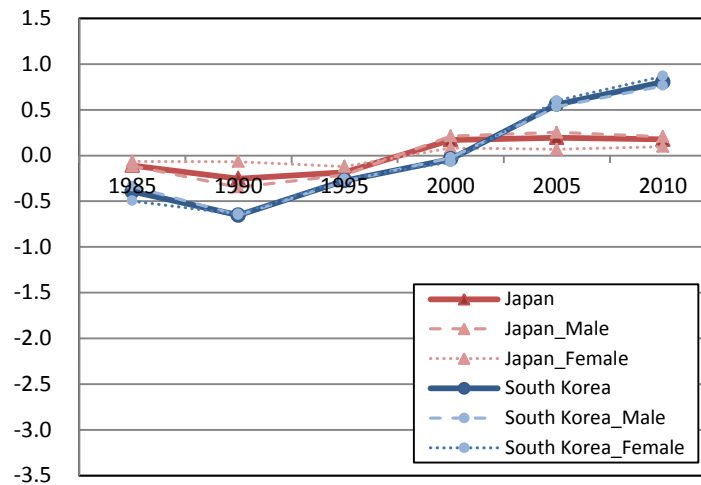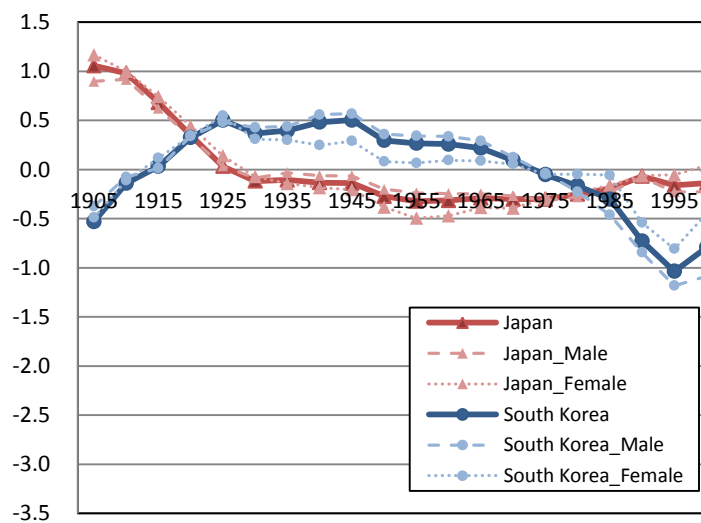

FIGURE 2.3 APC-IE Results: Suicide Mortality, Cohort Effects

REFERECES

Brenner, M. H. 1979. "Mortality and the National Economy." *The Lancet* 314(8142):568-573.

Cattell, H. 2000. "Suicide in the Elderly." *Advances in Psychiatric Treatment* 6:102-108.

Chang, S., D. Gunnell, J. A. C. Sterne, T. Lu, and T. A. Cheng. 2009. "Was the Economic Crisis 1997-1998 Responsible for Rising Suicide Rates in East/Southeast Asia? A Time-trend Analysis for Japan, Hong Kong, South Korea, Taiwan, Singapore and Thailand." *Social Science & Medicine* 68:1322-1331.

Durkheim, E. 1951. *Suicide: A Study in Sociology*. Trans. J. A. Spaulding and G.Simpson. Glencoe, IL.: Free Press. (Orig. pub. 1897)

Easterlin, R. A. 1978. "What Will 1984 Be Like? Socioeconomic Implications of Recent Twists in Age Structure." *Demography* 15 (4):397-432.

Fu, W. J. 2000. "Ridge Estimator in Singulah Oesiun with Application to Age-Period-Cohort Analysis of Disease Rates." *Communications in Statistics- Theory and Method* 29(2):263-278.

Hobcraft, J., J. Menken, and S. Preston. 1982. "Age, Period and Cohort Effects in Demography: A Review." *Population Index* 48(1):4-43.

Kim, S. Y., M. H. Kim, I. Kawachi, and Y. T. Cho. 2011. "Comparative Epidemiology of Suicide in South Korea and Japan: Effects of Age, Gender and Suicide Methods." *Crisis: The Journal of Crisis Intervention and Suicide Prevention* 32(1):5-14.

Lee, J. Y., S. H. Kim. 2010. "Suicide in Korea (in Korean)." *Korean Sociological Association* 44:63-94.

Leo, D. D. 2002. "Struggling Against Suicide: The Need for an Integrative Approach." *Crisis: The Journal of Crisis Intervention and Suicide Prevention* 23 (1):23-31.

Odagiri, Y., H. Uchida, and M. Nakano. 2011. "Gender Differences in Age, Period, and Birth-Cohort Effects on the Suicide Mortality Rate in Japan, 1985-2006." *Asia-Pacific Journal of Public Health* 23(4):581-587.

Ooe, Y., Y. Ohno, and T. Nakamura. 2009. "Age-Period-Cohort Analysis of Suicides among Japanese 1950-2003: A Bayesian Cohort Model Analysis." *The Journal of the Japan Hospital Association* 28: 71-8.

Organisastion for Economic Co-operation and Development (OECD). 2011. "OECD Health Data 2011." Retrieved June 30, 2011 (http://www.oecd.org/document/30/0,3746,en_2649_37407_12968734_1_1_1_37 407,00Html) .

Pampel, F. C., 1996. "Cohort Size and Age-Specific Suicide Rates: A Contingent Relationship." *Demography*, 33(3):341-355.

Park, B. C. B., and D. Lester. 2006. "Social Integration and Suicide in South Korea.″*Crisis: The Journal of Crisis Intervention and Suicide Prevention* 27(1):48-50.

Reither, E. N., R. M. Hauser, and Y. Yang. 2009. "Do Birth Cohorts Matter? Age-Period-Cohort Analyses of the Obesity Epidemic in the United States." *Social Science &Medicine* 69:10:1439-1448.

Robertson, G., S. Gandini, and P. Boyle. 1999. "Age-Period-Cohort Models: A Comparative Study of Available Methodologies." Journal of Clinical Epidemiology 52(6):569-583.

World Health Organization. 2000. "Mental Health: Introduction." Retrieved (http://www.who.int/mental_health/media/en/382.pdf).

Yang, B. 1992. "The Economy and Suicide: A Time-Series Study of the U.S.A." *American Journal of Economics and Sociology* 51(1):87-99.

Yang, Y. 2004. "APC Anlysis of Table of Rates: 1.1. Stata module." (http://www.unc.edu/~yangy819/apc/sectionE.html).

Yang, Y., S. Schulhofer-Wohl, W. J. Fu, and K. C. Land. 2008. "The Intrinsic Estimator for Age-Period-Cohort Analysis: What It Is and How to Use It." *American Journal of Sociology* 113(6):1697-1736.

Yang, Y., W. J. Fu, and K. C. Land. 2004. "A Methodological Comparison of Age-Period-Cohort Models: The Intrinsic Estimator and Conventional Generalized Linear Models." *Sociological Methodology* 34(1):75-110.