

The Five Elements and Chinese-American Mortality

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Abstract

Phillips, Ruth, and Wagner (1993) report that 1969-1990 California mortality data show that Chinese-Americans are particularly vulnerable to diseases that Chinese astrology and traditional Chinese medicine associate with their birth years. For example, because fire is associated with the heart, a Chinese person born in a fire year (like 1937) is more likely to die of heart disease than is a Chinese person born in a non-fire year. However, many diseases were excluded from this study, some diseases that were included have ambiguous links to birth years, and the statistical tests were indirect. A more complete statistical analysis and independent California mortality data for 1960-1968 and 1991-2002 do not replicate the original results.

Key words: Chinese astrology, traditional Chinese medicine, psychological stress, mortality

The Five Elements and Chinese-American Mortality

Each year in the Chinese lunar calendar is associated with one of Five Elements (fire, earth, metal, water, or wood). In traditional Chinese medicine (TCM), each of these elements is associated with a zang organ, which stores energy, and a fu organ, which produces energy and removes waste matter (Table 1). Phillips, Ruth, and Wagner (1993) argue that Chinese people who believe in Chinese astrology and TCM may be “ill-fated” for diseases that affect organs associated their birth year. For example, because 1937 is a fire year and the zang fire organ is the heart, a Chinese person born in 1937 may be more likely to die of heart disease than is a person born in a non-fire year. Because there are Five Elements, we would expect more than 20% of the Chinese people who die of heart disease to have fire birth years.

Such an association might be explained by the Health Belief Model (Hochbaum 1958; Rosenstock 1960, 1966), which predicts that health-related behavior may be affected by a person’s perceived susceptibility to disease and the anticipated costs and benefits of the behavior. For example, a person who believes he is doomed to die of heart disease may feel that it is pointless to take actions that might prevent or control heart disease.

Another possible explanation is the self-fulfilling prophecies model (Merton 1948, Rosenthal and Jacobson 1968), which predicts that a person’s behavior can be affected by others’ expectations; for example, that student achievement is influenced by teacher expectations. If a doctor believes that a patient is doomed to die of heart disease, this could conceivably affect the patient’s behavior and health, as well as the doctor’s diagnosis and treatment. In addition, someone who believes she is ill-fated for heart disease may experience chronic anxiety that helps produce the anticipated outcome.

Phillips et al. (1993) report that 1969-1990 California mortality data for Chinese-Americans

support their theory. However, they only look at 15 narrowly defined diseases. The current study looks at several related diseases and at more broadly defined disease categories. In addition, some theoretical ambiguities in categorizing diseases and the indirect nature of their statistical analysis make it especially important to see if independent data confirm the original results. This study uses 1960-1968 and 1991-2002 data to attempt to replicate their results. Because there are five Elements, one of the null hypotheses tested is that one-fifth of the Chinese-Americans dying of a particular disease have a birth year that is associated with the diseased organ. The second null hypothesis is that among those dying of a particular disease, the average age at death is the same for ill-fated and other Chinese-Americans.

Theoretical Issues

Statistical tests are most persuasive when applied to a concrete theory, specified in advance, that has well-defined, testable implications. Personal communications with three acupuncturists are the basis for the conjecture that, “When people contract a disease which is associated with the phase of their birth year, they may be more likely than others to feel helpless, hopeless, or stoic” (Phillips et al., 1993, p. 1142), and consequently be more vulnerable to this disease.

However, I have been told by three Chinese-Americans (Ju-Dai Chuang, personal communication, May 15, 2003; Lucy Hwang, personal communication, May 18, 2003; Hsing-Yun Wong, personal communication, May 18, 2003) who were born in China and believe in Chinese astrology and TCM that they had never heard that people are especially vulnerable to diseases of the organs associated with their birth year. According to Ji Zhang (personal communication, May 15, 2003), professor of TCM at Emperor’s College of Traditional Oriental Medicine, some TCM practitioners believe this theory, but the overwhelming majority do not.

There are also ambiguities in the theory’s details. It would be natural to identify diseases related to the ten zang and fu organs associated with the Five Elements. Instead, Phillips et al.

(1993) look at eight of the fifteen leading causes of death in the United States in 1969 and break two (diseases of the heart and malignant neoplasms) into nine subcategories to obtain the 15 diseases shown in Table 2. One problem is determining the appropriate birth years to associate with these 15 diseases; another problem is that these 15 categories are narrow and incomplete.

According to Zhang, there are several “mistakes” in these classifications. Diabetes can be associated with metal, earth, or water depending on whether the patient exhibits thirst, hunger, or urinary symptoms. The appropriate element for cancer depends on the organ; for example, stomach cancer would be earth, lung cancer would be metal, liver cancer would be wood. Of the eight leading causes that Phillips et al. (1993) omit, six are not associated with organs (for example, accidents and suicide), but two (cerebrovascular diseases and arteriosclerosis) are associated with the heart because TCM views organs as functional systems and the heart organ encompasses the cardiovascular system.

Matters are also complicated by the fact (Yuihe, 1992) that TCM considers organs to be interrelated: the kidney nourishes the liver (water generating wood), the liver nourishes the heart (wood generating fire), and the heart warms the spleen (fire generating earth). In addition, organs are associated with the opposing but complementary forces of Yin and Yang. For example, the heart is a Yin Fire organ and the small intestine is a Yang Fire organ. In Chinese astrology, each year is also Yin or Yang; for example, 1936 is Yang Fire and 1937 is Yin Fire. If the ill-fated theory were correct, a person might feel especially susceptible to diseases involving the small intestine if born in 1936 and to diseases involving the heart if born in 1937. Instead, Phillips et al. (1993) assume that someone born in either 1936 or 1937 feels susceptible to diseases of both the small intestine and the heart. Another issue is that the Five Elements are also associated with senses (tongue, mouth, nose, ear, and eye) and tissues (vessel, muscle, skin & hair, bone, and tendon), which have diseases that Phillips et al. (1993) ignore.

Thus, there are considerable ambiguities in the association of specific diseases with birth years. A second issue is that Phillips et al. (1993) only consider a few narrow subgroups of diseases related to the 10 organs in Table 1. For example, they look at nephritis and nephrosis (580-583), but not at kidney disease (590), which was one of the 15 leading causes of death in 1968, but not 1969. A more comprehensive grouping would be all diseases of the genitourinary system (580-629). Similarly, they consider bronchitis, emphysema, and asthma (490-493), but not acute bronchitis and bronchiolitis (466) or all respiratory system diseases (460-519). As yet another example, they look at chronic liver disease and cirrhosis (571), but not cholelithiasis and other gall bladder disorders (574-575).

Phillips et al. (1993) also divide heart disease and malignant neoplasms into nine unusual subgroups. Their stated theory is that Chinese people born in a fire year are more susceptible to heart disease, not that they are more susceptible to some kinds of heart disease and less susceptible to other kinds. The ICD-8 codes for heart diseases are 390-398, 402, 404, and 410-429. In his coauthored studies of Jewish deaths near Passover (Phillips & King, 1988) and Chinese deaths near the Harvest Moon Festival (Phillips & Smith, 1990), Phillips considers all heart-diseases to be a single group. In a coauthored study of Chinese- and Japanese-American deaths on the fourth day of the month (Phillips et al., 2001), Phillips only considers 410-414, which he calls “chronic heart diseases.” In this paper Phillips et al. (1993) divide heart diseases into these three groups: (a) 410; (b) 412, 414; and (c) 390-398, 402, 404, 411, 413-429. It is particularly puzzling that 410-414 would be broken up in this way.

Statistical tests are most compelling when they are applied to a clearly defined theory that is specified before the tests are conducted. The many theoretical ambiguities in how birth years might affect Chinese mortality argue for the importance of attempting to replicate the original findings with independent data.

Statistical Issues

The most natural test of the theory that birth year affects a person's susceptibility to certain diseases is to see whether more than one-fifth of the Chinese people dying of a particular disease had ill-fated birth years. Because Phillips et al. (1993) do not do this test, this study will calculate and report these results.

Another plausible test would be to see whether, among Chinese persons dying of a particular disease, those with ill-fated birth years died younger than those with other birth years. Instead, Phillips et al. (1993) compare the difference in the average age at death (AAD) of ill-fated and other Chinese-Americans with the difference in AAD of a sample of ill-fated and other white Americans. This is a nonstandard test and it is not clear how they calculated the standard error and p value for this difference between differences. It also answers a somewhat different question than that posed by the authors. They test the null hypothesis that the difference in the AAD of ill-fated and other Chinese-Americans is equal to the difference in AAD of ill-fated and other white Americans. This is one way of getting at the question of whether the birth-year effect is the same for Chinese- and white-Americans, but it does not answer the core question of whether there is a birth-year effect for Chinese-Americans. To answer that question, the current study will compare the AAD of ill-fated Chinese-Americans with the AAD of Chinese-Americans with other birth years.

Methods

The California Department of Health Services (1960-2002) maintains a mortality data base compiled from official death certificates. These files include all deaths that occur in the State of California and those out-of-state deaths of California residents that are reported to California officials. Data are available back to 1960 that identify each decedent's date of birth, date of death, cause of death, and race or ethnicity (including the category "Chinese"). These are the data used

by Phillips et al. (1993) for the years 1969-1990, augmented in this study by data for the years 1960-1968 and 1991-2002.

For each Chinese decedent, the ICD code was used to determine the disease category. The birth day, month, and year were matched with a Chinese lunar calendar to determine the appropriate element; for example, a person born between January 31, 1976 and February 17, 1977 was born in a fire year. The exact age at death was calculated from the day, month, and year of the decedent's birth and death. For each disease category, the decedents were separated into those who were born in a year with the matching element and those who were born in a year with one of the other four elements; for each of these two categories, the number of decedents was tabulated and the average age at death was calculated.

Analysis Plan

Using the original 1969-1990 data, a tabulation was made of the total number of Chinese-Americans who died of the 15 diseases studied by Phillips et al. (1993) and whether they were born in years associated with the diseased organ. Because there are five Elements, the null hypothesis is that each decedent has a 20% chance of having a birth year that is associated with the diseased organ. The binomial distribution gives the exact p value for testing this null hypothesis.

Comparisons were also made of the AAD of ill-fated and other Chinese-Americans for each of the 15 diseases studied by Phillips et al. (1993) and for the related diseases and broader disease categories discussed in the preceding section. The t distribution gives the p value for testing the null hypothesis that the expected value of the AAD is the same for ill-fated and other Chinese-Americans.

California data for nine pre-sample years 1960-1968 and twelve post-sample years 1991-2002 were used to attempt to replicate the statistically significant results that Phillips et al. (1993)

report for four diseases using 1969-1990 data: cancer of bronchus and lung (ICD-7 162.1; ICD-8 162.1; ICD-9 162.2-162.9; ICD-10 C33-34); cancer of lymphatic and hematopoietic tissues (ICD-7 200-205; ICD-8 200-209; ICD-9 200-208; ICD-10 C81-96); acute myocardial infarction (ICD-7 420; ICD-8 410; ICD-9 410; ICD-10 I21-22., I24); bronchitis, emphysema, and asthma (ICD-7 501-502, 527.1, 241; ICD-8 490-493; ICD-9 490-493; ICD-10 J40-43, J45-46)). The only substantial modification in these codes is that ICD-7 does not have a category corresponding to ICD-8 410; instead ICD-7 420 encompasses ICD-8 410-413.

First, a count was made of the number of Chinese-Americans with ill-fated and other birth years who died of the disease; second, the AAD was calculated for these two groups. Phillips et al. (1993) report that their results are strongest for Chinese-Americans who are most committed to Chinese astrology and TCM, as proxied by being born in China, residing in Los Angeles or San Francisco (which have large Chinese communities), and not having an autopsy (which was forbidden in ancient times by TCM). Similar calculations were made for this subgroup. The binomial and t distributions were again used to calculate the p values.

Results

Original Data, 1969-1990

For the fifteen diseases that Phillips et al. (1993) report, there were a total of 21,171 deaths of which 4,251 (20.08%) had an ill-fated birth year. This is neither substantial nor statistically persuasive evidence against the null hypothesis that 20% of the Chinese-Americans who die from these disease have ill-fated birth years, exact binomial $p(\text{two-tailed}) = 0.77$. Among the four diseases (labeled with asterisks in Table 2) that they conclude provide evidence of a link between birth year and cause of death, there were 6,367 deaths of which 1,273 (19.99%) had an ill-fated birth year, exact binomial $p(\text{two-tailed}) = 1.00$.

A comparison of the AADs of ill-fated and other Chinese-Americans for the 15 diseases in

Table 2 shows that only two diseases had p values less than 0.05: cancer of bronchus and lung, $t(703) = 2.29$, $p = .022$, and bronchitis, emphysema, and asthma, $t(147) = 2.59$, $p = .010$. The other two diseases considered statistically persuasive by Phillips et al. (1993) were cancer of lymphatic and hematopoietic tissues, $t(191) = 1.95$, $p = .052$, and acute myocardial infarction, $t(899) = 1.70$, $p = .090$.

As noted above, the 15 reported tests are for unusual and restrictive subgroups of broader categories. Table 3 shows the number of deaths and the AADs for the related and broader disease categories discussed above. There are a total of 15,875 nonoverlapping deaths, of which 3,077 (19.38%) had ill-fated birth years, exact binomial $p(\text{two-tailed}) = 0.052$.

The ill-fated have a slightly lower AAD for cerebrovascular diseases and a somewhat higher AAD for arteriosclerosis, but neither is close to being statistically persuasive. Phillips et al. (1993) report that the ill-fated with nephritis and nephrosis (580-583) have a lower AAD; they do not report that the ill-fated with kidney disease (590) have a higher AAD. If we group together all diseases of the genitourinary system (580-629), the ill-fated have a higher AAD.

Similarly, they report that the ill-fated with bronchitis, emphysema, and asthma (490-493) have a relatively low AAD that is statistically persuasive; however, the ill-fated actually have relatively long lives if we look at acute bronchitis and bronchiolitis (466) or at all respiratory system diseases (460-519).

They also report that the ill-fated with chronic liver disease and cirrhosis (571) have a relatively low AAD, but do not report that the ill-fated with cholelithiasis and other gall bladder disorders (574-575) have a high AAD. Finally, they report that the ill-fated with acute myocardial infarction (410) have a lower AAD that is statistically persuasive. However, the results are not statistically persuasive for the heart diseases studied in Phillips et al. (2001) or for all heart diseases.

Out-of-Sample Data, 1960-1968, 1991-2002

Table 4 shows that, among the four diseases for which Phillips et al. (1993) report statistically significant results, there were 1,344 deaths during the pre-sample period 1961-1968, of which 279 (20.76%) had ill-fated birth years, exact binomial $p(\text{two-tailed}) = 0.51$, and 8,015 deaths during the post-sample period 1991-2002, of which 1,597 (19.93%) had ill-fated birth years, exact binomial $p(\text{two-tailed}) = 0.88$. Overall, there were 9,359 deaths of which 1,876 (20.04%) had ill-fated birth years, exact binomial $p(\text{two-tailed}) = 0.92$. For both the pre-sample and post-sample periods, none of the observed differences in AADs have p values less than 0.05. Overall, the AAD is 0.4 years shorter for those with ill-fated birth years, $t(2897) = 1.14$, $p = .254$.

Table 5 shows the pre-sample and post-sample results for those Chinese-Americans Phillips et al. (1993) consider to be most committed to Chinese astrology and TCM. Overall, 840 of these 4,207 decedents (19.97%) had ill-fated birth years, exact binomial $p(\text{two-tailed}) = 0.97$. For both the pre-sample and post-sample periods, none of the observed differences in AADs have p values less than 0.05. Overall, the AAD is 0.1 years longer for those with ill-fated birth years, $t(1321) = 0.22$, $p = .826$.

For all 15 diseases in Table 2, 19.8% of all Chinese decedents (exact binomial $p(\text{two-tailed}) = 0.475$) and 20.2% of the most committed Chinese decedents (exact binomial $p(\text{two-tailed}) = 0.570$) had ill-fated birth years. The ill-fated AAD was 0.1 years longer for all Chinese decedents ($t(9305) = 1.46$, $p = 0.144$) and 0.1 years shorter for the most committed ($t(4027) = 0.38$, $p = 0.706$).

Discussion

If it were true that people who believe in Chinese Astrology and TCM are more vulnerable to diseases associated with their birth years, this would have important implications for treating

patients, understanding diseases, and conducting medical studies. For example, if Chinese people born in earth years are more vulnerable to lung cancer, doctors should make a special effort to detect lung cancer in such patients; researchers should study how lung cancer is affected and perhaps treated by psychological factors; and medical studies of lung cancer should consider birth year to be a confounding influence for Chinese subjects.

Phillips et al. (1993) report that California mortality data for 1969-1990 indicate that Chinese-Americans are unusually vulnerable to diseases of the zang and fu organs associated with their birth year. However, among those Chinese-Americans dying of the 15 narrowly defined diseases that were reported, almost exactly 20% had birth years associated with that organ—just what one would expect if birth year were irrelevant. Furthermore, in only 2 of 15 cases are there statistically persuasive differences in the average age at death of Chinese-Americans with ill-fated birth years and Chinese-Americans with other birth years. For several diseases excluded from the study and for broader categories of diseases, there is no statistically persuasive evidence of a birth-year effect.

Phillips and Smith (1990, p. 1947) observe that, “It is a scientific truism that statistical significance alone is not sufficient to justify substantial confidence in the reliability of a finding. It is crucial that the finding be replicated also.” Several theoretical and statistical issues suggest that the original results be viewed skeptically unless they are confirmed with independent data. California mortality data for 1960-1968 and 1991-2002 do not replicate the results reported for 1969-1990. For the four diseases Phillips et al. (1993) identify as most significant, almost exactly 20% of the decedents had ill-fated birth years and there were no substantial or statistically persuasive differences in the average age at death of ill-fated and other Chinese-Americans. The same is true for those Chinese-Americans they consider to be most committed to Chinese astrology and TCM.

One limitation of these data is that living in California may weaken the effects of traditional Chinese beliefs on health. The proxies of being born in China, residing in Los Angeles or San Francisco, and not having an autopsy may be weakly related to the strength of one's belief in Chinese astrology and TCM. As far as I know, there have been no relevant studies of the birth-year effect using mortality data from China.

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Table 1

The Five Elements and Human Organs

	Zang Organ (Yin)	Fu Organ (Yang)
fire	heart	small intestine
earth	spleen	stomach
metal	lungs	large intestine
water	kidney	urinary bladder
wood	liver	gall bladder

Table 2

Average Age at Death (AAD) for the Diseases Reported by Phillips et al. (1993), 1969-1990 data, ICD-8 codes in Parentheses

	Element	Ill-Fated		Other		2-Sided
		AAD	n	AAD	n	P-Value
Cancer of digestive organs (150-9)	earth	66.3	626	67.5	2438	0.057
* Cancer of bronchus and lung (162.1)	earth	67.8	464	69.2	1690	0.022
Cancer of breast (female) (174)	earth	59.7	90	61.1	376	0.414
Cancer of genitourinary organs (180-9)	earth	68.7	168	68.5	713	0.872
* Cancer of lymphatic & hematopoietic tissues (200-9)	earth	60.0	123	63.3	482	0.052
All other cancers (other 140-209)	earth	61.9	300	63.0	1127	0.308
* Acute myocardial infarction (410)	fire	72.6	595	73.4	2591	0.090
Chronic ischemic heart disease (412)	fire	75.9	740	76.2	3114	0.549
All other heart diseases (390-8, 402, 404, 411, 413-29)	fire	74.4	489	73.9	1923	0.472
Diabetes mellitus (250)	earth	72.8	148	73.2	537	0.691
Peptic ulcer (531-3)	earth	74.7	43	75.6	170	0.632
Influenza and pneumonia (470-4, 480-6)	metal	79.6	235	78.2	860	0.102
* Bronchitis, emphysema, and asthma (490-3)	metal	67.7	91	71.6	331	0.010
Nephritis & nephrosis (580-4)	water	77.1	62	74.9	290	0.190
Cirrhosis of liver (571)	wood	63.8	77	64.2	278	0.808

* identified by Phillips et al. (1993) as statistically persuasive

Table 3

Average Age at Death (AAD) for Some Diseases Not Reported by Phillips et al. (1993), 1969-1990 data, ICD-8 codes in Parentheses

	Element	Ill-Fated		Other		2-Sided P-Value
		AAD	n	AAD	n	
Cerebrovascular diseases (430-438)	fire	74.1	588	74.2	2565	.802
Arteriosclerosis (440)	fire	82.8	36	82.5	146	.829
Infections of kidney (590)	water	79.3	9	74.1	40	.184
All diseases of the genitourinary system (580-629)	water	77.2	126	75.1	533	.095
Acute bronchitis and bronchiolitis (466)	metal	79.3	4	75.2	10	.594
All respiratory diseases (460-519)	metal	76.6	490	75.8	1850	.211
Cholelithiasis, cholecystitis, and cholangitis (574-575)	wood	80.7	13	77.1	76	.157
Heart diseases in Phillips et al, 2001 (410-414)	fire	74.4	1341	74.9	5719	.151
All diseases of the heart (390-398, 402, 404, 410-429)	fire	74.4	1824	74.7	7628	.408

Table 4
Average Age at Death (AAD) Using Out-of-Sample Data for All Chinese-Americans

	Element	Ill-Fated		Other		2-Sided P-Value
		AAD	n	AAD	n	
1960-1968						
Cancer of bronchus and lung	earth	66.4	18	62.0	82	.139
Cancer of lymphatic and hematopoietic tissues	earth	55.5	19	56.5	53	.869
Acute myocardial infarction	fire	68.3	229	68.5	851	.733
Bronchitis, emphysema, and asthma	metal	62.8	13	64.6	79	.701
Total		67.0	279	67.1	1065	.876
1991-2002						
Cancer of bronchus and lung	earth	71.7	646	72.1	2560	.376
Cancer of lymphatic and hematopoietic tissues	earth	67.7	219	67.2	826	.676
Acute myocardial infarction	fire	77.9	643	78.3	2645	.447
Bronchitis, emphysema, and asthma	metal	73.4	89	73.6	387	.900
Total		73.8	1597	74.1	6418	.295
1960-1968, 1991-2002						
Cancer of bronchus and lung	earth	71.6	664	71.9	2642	.573
Cancer of lymphatic and hematopoietic tissues	earth	66.7	238	66.5	879	.870
Acute myocardial infarction	fire	75.4	872	75.9	3496	.235
Bronchitis, emphysema, and asthma	metal	72.0	102	72.1	466	.981
Total		72.7	1876	73.1	7483	.254

Table 5

Average Age at Death (AAD) Using Out-of-Sample Data for Chinese-Americans Most Committed to Astrology and TCM

	Element	Ill-Fated		Other		2-Sided
		AAD	n	AAD	n	P-Value
1960-1968						
Cancer of bronchus and lung	earth	64.3	8	61.9	41	.376
Cancer of lymphatic and hematopoietic tissues	earth	50.5	7	60.4	16	.306
Acute myocardial infarction	fire	70.5	73	69.6	294	.491
Bronchitis, emphysema, and asthma	metal	68.1	4	67.1	19	.801
Total		68.3	92	68.2	370	.953
1991-2002						
Cancer of bronchus and lung	earth	73.6	301	73.3	1237	.712
Cancer of lymphatic and hematopoietic tissues	earth	72.4	83	70.5	328	.287
Acute myocardial infarction	fire	79.6	320	80.1	1262	.434
Bronchitis, emphysema, and asthma	metal	76.7	44	77.6	170	.603
Total		76.4	748	76.1	2997	.833
1960-1968, 1991-2002						
Cancer of bronchus and lung	earth	73.4	309	73.0	1278	.580
Cancer of lymphatic and hematopoietic tissues	earth	70.7	90	70.1	344	.734
Acute myocardial infarction	fire	77.9	393	78.1	1556	.737
Bronchitis, emphysema, and asthma	metal	76.0	48	76.6	189	.727
Total		75.4	840	75.3	3367	.826