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Annual per Capita Apparent Consumption of Tobacco Products in the United States: 1900–1990[1]

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Background. **Analyses of secular trends in tobacco consumption can provide evidence of potential tobacco–disease relationships and have utility in terms of public health projections and policy. The purpose of this project was to provide a unique set of continuous apparent tobacco product consumption estimates for the United States over the period spanning 1900 through 1990.**

Methods. **Two U.S. Department of Agriculture data sources provide information on long-term apparent tobacco consumption in the United States; however, differences exist between these data sets. The consumption estimates in these reports were adjusted to a common population base. A 9-year overlap of the data sets was then used to calibrate one data series to the other using inverse regression. Predicted tobacco consumption estimates for the years 1900 through 1944 were then combined with the adjusted 1945–1990 data.**

Results. **Inverse regression showed a strong linear relationship between the two U.S. Department of Agriculture summaries for each tobacco product during the 9-year overlap period. A continuous set of annual per capita tobacco consumption estimates is reported by product for the United States.**

Conclusions. **The two U.S. Department of Agriculture reports can be combined to provide a history of tobacco product consumption in the United States over the period 1900–1990.**

Key Words: **tobacco; epidemiology; ecological; consumption; regression analysis; calibration.**

INTRODUCTION

Studies have implicated tobacco use as an important risk factor for diseases and conditions as diverse as cancer, heart disease, low birth weight pregnancies, chronic obstructive pulmonary disease, and periodontal disease [*1-3*], and the 1979 *Smoking and Health* report of the United States Surgeon General states that "no sound epidemiologic study of chronic disease today would omit from its design a history of tobacco as a significant factor" [*4*].

The analysis of secular trends in tobacco consumption can provide evidence of potential tobacco–disease relationships and has utility in terms of public health projections and policy. For such applications it is often useful to have long-term, comparable data on tobacco product consumption. While high quality data, such as that from the National Health Interview Surveys, do exist, they are limited in terms of the historical period covered. Long-term tobacco disappearance data are also available; however, the sources used in their estimation are subject to limitations, including changes in product classification over time. In addition, long-term disappearance data may not be directly comparable from one report to the next given differences in the manner in which such figures were calculated and ultimately presented.

Two data sources, each compiled by the U.S. Department of Agriculture (USDA), provide information on long-term apparent tobacco consumption in the United States. Data for the years 1880–1954 were presented by Milmore and Conover [*5*], while Creek *et al.* provide figures for the period 1935–1994 [*6*]. Notably, however, differences exist between these two data sets. First, Milmore and Conover calculated per capita tobacco consumption figures using a U.S. population base of persons ages 15 and over, while Creek *et al.* based their calculations on the population ages 18 and over. Second, while Milmore and Conover based all per capita consumption estimates on the combined U.S. male and

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female population, Creek *et al.* restricted per capita estimates for some tobacco products (e.g., cigars) to a population base of U.S. males only. Third, the two data sets differ in terms of whether finished or unstemmed tobacco weights were used in the calculation of consumption estimates. Fourth, there is a minor difference between the data sets in terms of their treatment of overseas armed forces, with such personnel being included for all years with the exception of those prior to 1940.

The purpose of this project was to adjust for differences in the two tobacco consumption databases, and ultimately provide a unique set of continuous apparent tobacco product consumption estimates for the United States over the period spanning 1900 through 1990.

METHODS

In this analysis, two sources of estimated per capita tobacco consumption data were used, figures previously presented by Milmore and Conover and estimates provided by Creek *et al.*

In order to estimate tobacco available for consumption in the United States during the period 1880–1954, Milmore and Conover used Internal Revenue Service records of "production, importation and tax-paid and tax-free removal for domestic consumption." USDA marketing data were utilized in order to estimate the proportional allocation of tobacco to product category (i.e., cigarettes, smoking, smokeless, cigars, and snuff). These figures were then used to produce gross poundage estimates for each such category that were, in turn, divided by the population ages 15 and older, as estimated by U.S. Census Bureau statistics. Findings were presented in terms of per capita consumption of unstemmed tobacco by product (in pounds), for the population over 14 years of age. Consumption estimates for the year 1954 were considered "provisional" and, therefore, not used in the current analysis.

In order to estimate U.S. tobacco consumption for the years 1935–1994, Creek *et al.* used information that included USDA marketing and statistics services, and U.S. Treasury Department data, as well as other governmental and private (e.g., Tobacco Institute) sources. As with Milmore and Conover, cigarette and cigar apparent consumption was reported in terms of unstemmed processing weight. Unlike Milmore and Conover, smoking tobacco (for roll-your-own cigarettes and pipe usage) and smokeless tobacco (chewing and snuff)

TABLE 1

Adjusted Apparent per Capita Tobacco Consumption (lb) by Product Category, 1900–1953; Based on Data Provided by Millmore and Conover, 1956[a]

Year	Cigarettes	Cigars	Smoking	Smokeless	Year	Cigarettes	Cigars	Smoking	Smokeless
1900	0.18	2.19	1.56	4.25	1927	3.73	2.10	1.55	2.39
1901	0.18	2.29	1.65	4.17	1928	3.90	2.08	1.46	2.29
1902	0.15	2.62	1.87	4.46	1929	4.26	2.02	1.50	2.24
1903	0.20	2.52	1.96	4.51	1930	4.18	1.82	1.57	2.07
1904	0.21	2.48	2.20	4.50	1931	3.94	1.66	1.73	1.85
1905	0.21	2.54	2.39	4.31	1932	3.48	1.35	1.88	1.59
1906	0.25	2.63	2.35	4.37	1933	3.79	1.33	1.83	1.50
1907	0.29	2.60	2.36	4.25	1934	4.27	1.40	1.85	1.52
1908	0.31	2.40	2.32	4.14	1935	4.45	1.41	1.65	1.39
1909	0.35	2.41	2.38	4.39	1936	5.00	1.52	1.65	1.40
1910	0.45	2.40	2.38	4.18	1937	5.21	1.52	1.59	1.38
1911	0.53	2.49	2.41	4.03	1938	5.16	1.42	1.64	1.27
1912	0.66	2.48	2.41	4.01	1939	5.36	1.43	1.57	1.20
1913	0.78	2.58	2.27	3.86	1940	5.58	1.47	1.62	1.19
1914	0.81	2.48	2.25	3.61	1941	6.42	1.53	1.44	1.17
1915	0.89	2.37	2.32	3.58	1942	7.55	1.52	1.22	1.23
1916	1.23	2.53	2.23	3.78	1943	8.59	1.38	1.10	1.26
1917	1.72	2.63	2.13	3.80	1944	8.63	1.31	0.88	1.22
1918	1.85	2.46	2.21	3.41	1945	9.80	1.35	1.03	1.17
1919	2.15	2.38	1.85	3.19	1946	9.87	1.46	0.64	1.06
1920	2.06	2.66	1.63	3.08	1947	9.77	1.38	0.63	0.97
1921	2.25	2.18	1.70	2.81	1948	9.95	1.39	0.62	0.94
1922	2.33	2.35	1.82	2.84	1949	9.90	1.23	0.63	0.90
1923	2.73	2.41	1.73	2.91	1950	9.92	1.25	0.63	0.88
1924	2.93	2.24	1.77	2.66	1951	10.58	1.26	0.56	0.83
1925	3.23	2.17	1.75	2.64	1952	11.03	1.34	0.52	0.81
1926	3.45	2.17	1.67	2.55	1953	11.09	1.34	0.47	0.78

[a] Adjusted to a population base of males and females ages 18^{+}. Excludes overseas armed forces 1900–1939; includes overseas armed forces 1940–1953.

TABLE 2

Adjusted Apparent per Capita Tobacco Consumption (lb) by Product Category, United States, 1945–1990[a]

Year	Cigarettes	Cigars	Smoking	Smokeless	Year	Cigarettes	Cigars	Smoking	Smokeless
1945	9.44	1.35	1.70	1.60	1968	8.69	1.03	0.53	0.71
1946	9.43	1.45	1.05	1.50	1969	8.11	1.01	0.52	0.72
1947	9.12	1.38	1.02	1.34	1970	7.77	1.00	0.55	0.70
1948	9.42	1.38	1.03	1.32	1971	7.75	0.93	0.51	0.71
1949	9.45	1.23	1.03	1.24	1972	7.95	0.83	0.48	0.70
1950	9.54	1.25	1.00	1.20	1973	7.92	0.77	0.42	0.71
1951	9.94	1.26	0.93	1.17	1974	7.90	0.70	0.42	0.72
1952	10.44	1.34	0.89	1.14	1975	7.73	0.63	0.36	0.72
1953	10.37	1.34	0.80	1.12	1976	7.35	0.57	0.36	0.73
1954	9.59	1.30	0.76	1.08	1977	7.21	0.54	0.31	0.74
1955	9.49	1.28	0.72	1.06	1978	6.89	0.50	0.29	0.76
1956	9.35	1.18	0.64	1.01	1979	7.00	0.43	0.24	0.77
1957	9.21	1.12	0.62	0.95	1980	6.78	0.40	0.22	0.79
1958	9.46	1.14	0.67	0.91	1981	6.52	0.39	0.22	0.77
1959	9.44	1.15	0.64	0.88	1982	6.45	0.35	0.20	0.78
1960	9.64	1.18	0.63	0.85	1983	6.19	0.34	0.19	0.77
1961	9.84	1.18	0.63	0.84	1984	5.89	0.33	0.17	0.77
1962	9.69	1.17	0.60	0.81	1985	5.90	0.30	0.15	0.76
1963	9.70	1.16	0.59	0.81	1986	5.72	0.28	0.14	0.71
1964	9.22	1.30	0.69	0.80	1987	5.50	0.25	0.13	0.68
1965	9.37	1.24	0.57	0.76	1988	5.35	0.23	0.12	0.67
1966	9.08	1.16	0.55	0.74	1989	4.93	0.23	0.11	0.66
1967	8.86	1.10	0.52	0.73	1990	4.76	0.21	0.10	0.66

[a] Based on data provided by Creek *et al.* [*6*]. Adjusted to a population base of U.S. males and females aged 18^{+}. Includes overseas armed forces.

products were measured by finished product weight. Although the population base used by Creek *et al.* included persons ages 18 years and over for all tobacco categories, the apparent per capita consumption estimates for cigar, smoking, and chewing tobaccos were reported for *males* only. Finally, although the statistics presented by Creek *et al.* spanned the years 1935 through 1994, apparent consumption estimates for the 10-year period 1935–1944 were presented in 5-year intervals, while those for the years 1993 and 1994 were regarded as "preliminary." Consequently, estimates for these years were not included in our analysis.

Using these two USDA data sets, estimates of apparent tobacco consumption by product type for the period 1900–1990 were derived. The tobacco consumption figures were recomputed to a common population base of U.S. females and males ages 18 and over. This produced an adjusted and unadjusted data series for each product type. These figures were then tabulated and graphed for each of the tobacco product categories.

The Milmore and Conover data, originally reported in terms of persons ages 15 years and older, were recalculated for the population ages 18 years and over using U.S. Census Bureau annual estimates [*7–9*]. As in the original report, population estimates included overseas armed forces for the years 1940 and beyond, but excluded such forces prior to that time period. For each given year, the previously reported per capita consumption (in pounds), by tobacco category, was multiplied by the corresponding annual population estimate for persons ages 15 years and older and then divided by the population estimates for persons aged 18 years and over.

With regard to the data presented by Creek *et al.*, both cigarette and snuff consumption were reported using a population base of U.S. males and females ages 18 years and over; therefore, no adjustment of these figures was necessary. Because data for cigars, smoking, and chewing tobacco were originally presented in terms of a male-only population base, we recalculated these figures to include both males and females ages 18 years and over. Further, because a definition change in 1982 resulted in all fine cut chewing tobacco being redefined as snuff, we elected to combine the consumption estimates for chewing tobacco and snuff under the heading of "smokeless tobacco."

Fortuitously, the two data sets overlap for the 9-year period 1945–1953, thereby allowing for the evaluation of data consistency over those years. In order to calibrate the two data sets, inverse linear regression was carried out for each of the product types using the adjusted data of Creek *et al.* as the dependent variable and the adjusted data of Milmore and Conover as the independent predictor variable [*10*]. The data of Creek *et al.* were considered the "gold standard" for the calibration because these figures were derived from additional sources relative to the consumption estimates presented by Milmore and Conover and because they represent the most recent data available.

Evidence that the annual consumption estimates

from the two data sets were comparable over the overlap period would be indicated by a high R^2 value, demonstrating a linear relationship and allowing for a constant bias such as differences in data source as well as the difference introduced by differentially using processed and unstemmed weights. If the calibration regressions yield R^2 values that approach 1.0, the inverse regressions (X_I regressed on Y_I, or the data of Creek *et al.* regressed on those of Milmore and Conover) can be carried out with minimal bias [*10–11*]. Using inverse regression and the adjusted values from the two data sources, predicted product consumption for the years prior to 1945 is estimable, producing figures that are generated based on the data of Milmore and Conover and the methodology of Creek *et al.*

Historically, males have been the predominant users of cigars and smokeless tobacco; thus, we also estimated male-only use of these products using the adjusted data of Creek *et al.* (1945–1990) and the predicted values (1900–1944) obtained from inverse regression. These annual per capita consumption estimates were multiplied by the applicable yearly U.S. population figures for persons ages 18+ in order to obtain the total annual poundage of each tobacco product consumed. Each of these values was then divided by the relevant U.S. population estimate for males aged 18+ in order to produce the male-only consumption estimates.

RESULTS

Tables 1 and 2 present, for each of the two data sources and for each product category, apparent per capita tobacco consumption estimates standardized to reflect the U.S. male and female population ages 18 and over. Figures 1–4 present the original (unadjusted) and adjusted estimates for the apparent consumption of each of the tobacco products for the period spanning 1900 through 1990. The cigarette data from Creek *et al.* have undergone no adjustment (the population being U.S. males and females 18 and over), and smokeless tobacco estimates are for the adjusted combined snuff and chewing categories. Trends in per capita apparent consumption by tobacco product are discernible within each of the tables and figures. For each form of tobacco examined, the trend in consumption during the overlap period was consistent across the two data sources.

Within the 1945–1953 overlap period, estimates of per capita cigarette consumption were slightly higher for the adjusted data of Milmore and Conover relative to the figures of Creek *et al.* (Fig. 1). The maximum difference during that period was approximately 7%, or 0.64 pounds in 1947. Cigar values (Fig. 2) are virtually identical for both adjusted data sources. With regard to smoking tobacco consumption (Fig. 3), trends during the overlap period are similar for the two summaries; however, a discrepancy in the estimates following adjustment of the original data remains. This difference

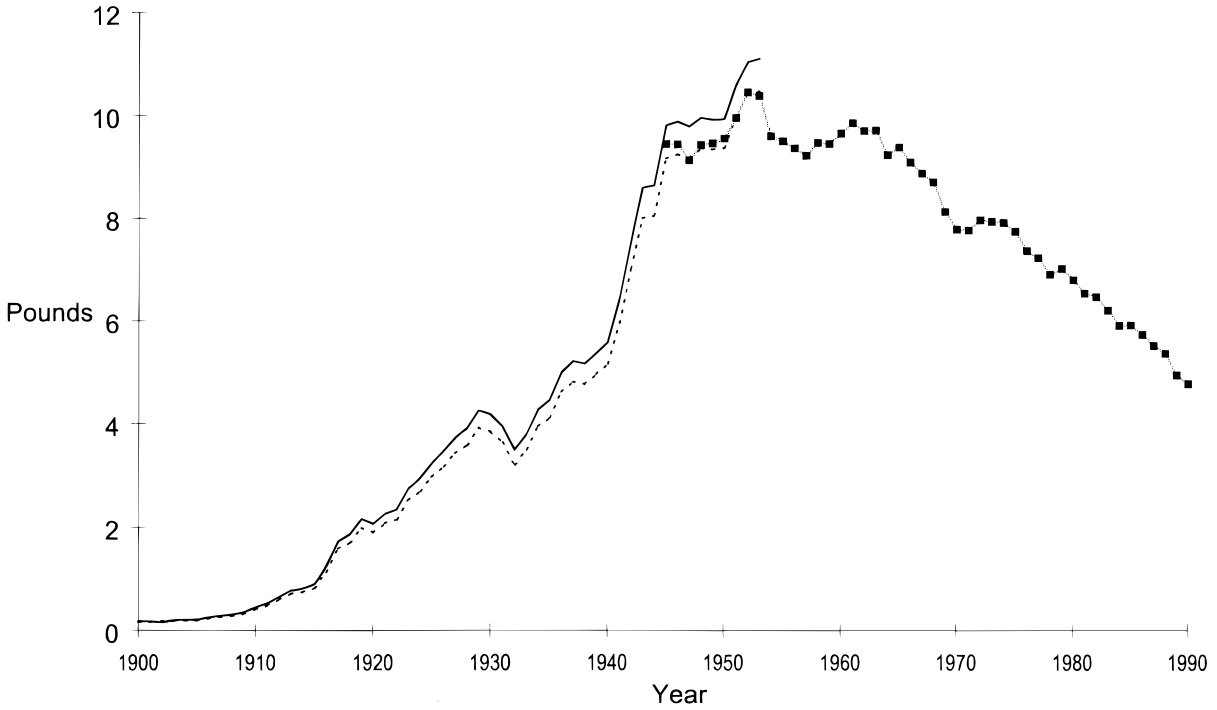

FIG. 1. Cigarette tobacco: apparent per capita consumption (lb), United States: 1900–90. (——) Milmore and Connover, adjusted [*5*]; (------) Milmore and Connover, unadjusted [*5*]; (—■—) Creek *et al.*, adjusted [*6*].

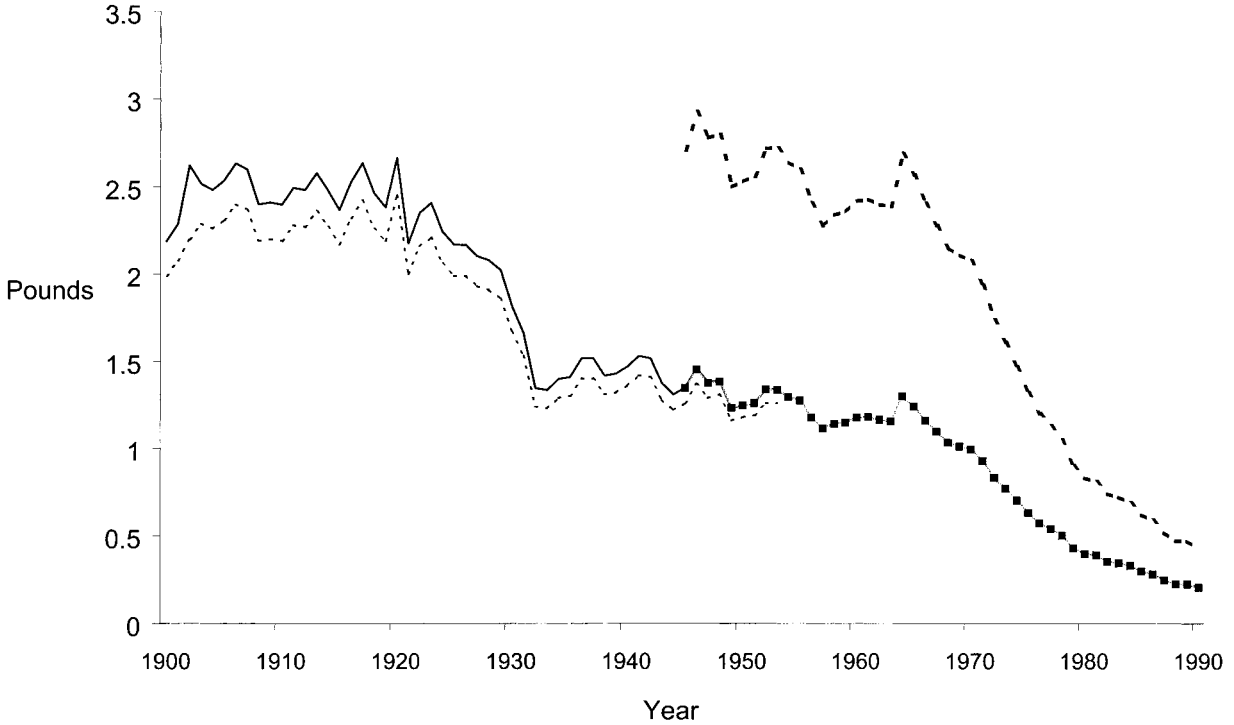

FIG. 2. Cigar tobacco: apparent per capita consumption (lb), United States: 1900–1990. (——) Milmore and Connover, adjusted [*5*]; (------) Milmore and Connover, unadjusted [*5*]; (—■—) Creek *et al.*, adjusted [*6*]; (– – –) Creek *et al.*, unadjusted [*6*].

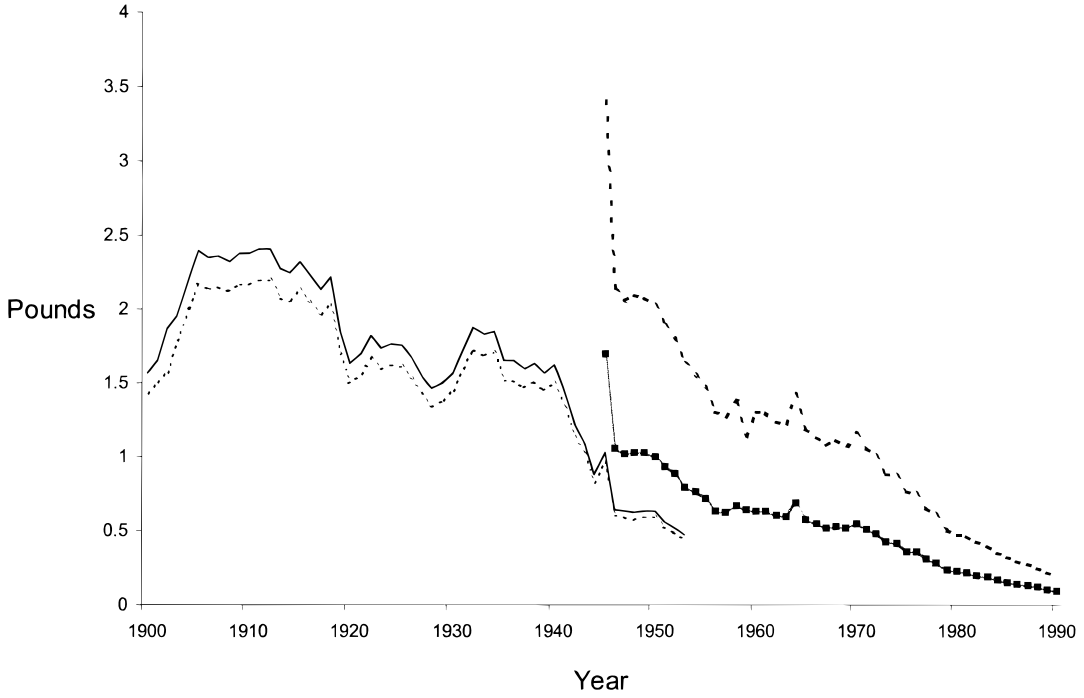

FIG. 3. Smoking tobacco: apparent per capita consumption (lb), United States: 1900–1990. (——) Milmore and Connover, adjusted [*5*]; (------) Milmore and Connover, unadjusted [*5*]; (—■—) Creek *et al.*, adjusted [*6*]; (– – –) Creek *et al.*, unadjusted [*6*].

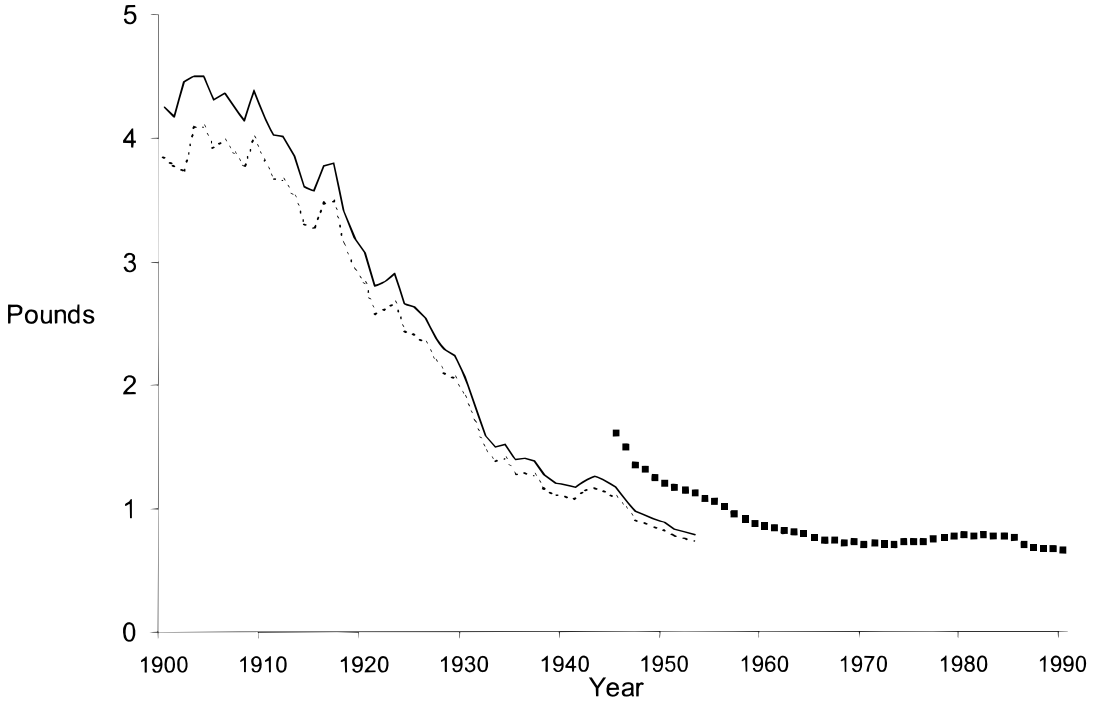

FIG. 4. Smokeless tobacco: apparent per capita consumption (lb), United States 1900–1990. (——) Milmore and Connover, adjusted [*5*]; (------) Milmore and Connover, unadjusted [*5*]; (—■—) Creek *et al.*, adjusted [*6*].

is small in absolute terms, but is still notable on a relative basis, the estimates of Creek *et al.* being higher. Smokeless tobacco consumption (Fig. 4) shows the same pattern as smoking tobacco following its adjustment; i.e., trends are similar using either database, while the specific data value differences are large in percentage terms.

When inverse regression was carried out for each of the four forms of tobacco, the corresponding adjusted R^2 for each regression was greater than 0.95 (Table 3). Predicted tobacco consumption estimates for each of the four forms of tobacco over the years 1900–1944, as obtained via inverse regression, were then combined with the adjusted 1945–1990 figures derived from data provided by Creek et al. in order to produce a common data set for the years 1900 through 1990 (Table 4). These results are presented graphically in Fig. 5.

Table 5 presents cigar and smokeless tobacco apparent consumption estimates for males only, reflecting the historical pattern of predominately male use of these products.

DISCUSSION

This article provides a continuous set of apparent tobacco consumption estimates, by product type, for the United States during the period 1900–1990. The trends

TABLE 3

Results of Inverse Regressions for the Years 1945–1953 by Tobacco Product Type

Product type		Beta	SE	*P* value	Adjusted R^2
Cigarettes	Intercept	−0.847	0.88	0.368	0.952
	Parameter estimate	1.142	0.091	0.0009	
Cigars	Intercept	−0.05429	0.034	0.15	0.995
	Parameter estimate	1.107	0.027	0.0009	
Smoking	Intercept	−0.01105	0.019	0.579	0.994
	Parameter estimate	0.617	0.018	0.0009	
Smokeless	Intercept	−0.04162	0.04	0.329	0.987
	Parameter estimate	0.748	0.03	0.0009	

TABLE 4

Apparent per Capita Tobacco Product Consumption (lb), United States: 1900–1990[a]

	Cigarettes	Cigars	Smoking	Smokeless		Cigarettes	Cigars	Smoking	Smokeless
1900	1.27	2.16	2.54	5.68	1945	9.44	1.35	1.70	1.60
1901	1.27	2.25	2.68	5.58	1946	9.43	1.45	1.05	1.50
1902	1.25	2.57	3.04	5.96	1947	9.12	1.38	1.02	1.34
1903	1.29	2.47	3.17	6.02	1948	9.42	1.38	1.03	1.32
1904	1.30	2.44	3.56	6.02	1949	9.45	1.23	1.03	1.24
1905	1.30	2.49	3.88	5.77	1950	9.54	1.25	1.00	1.20
1906	1.33	2.58	3.81	5.84	1951	9.94	1.26	0.93	1.17
1907	1.36	2.55	3.82	5.69	1952	10.44	1.34	0.89	1.14
1908	1.38	2.36	3.77	5.54	1953	10.37	1.34	0.80	1.12
1909	1.41	2.37	3.85	5.87	1954	9.59	1.30	0.76	1.08
1910	1.50	2.36	3.85	5.59	1955	9.49	1.28	0.72	1.06
1911	1.56	2.45	3.90	5.39	1956	9.35	1.18	0.64	1.01
1912	1.67	2.43	3.90	5.37	1957	9.21	1.12	0.62	0.95
1913	1.77	2.53	3.68	5.16	1958	9.46	1.14	0.67	0.91
1914	1.80	2.43	3.64	4.84	1959	9.44	1.15	0.64	0.88
1915	1.87	2.32	3.76	4.79	1960	9.64	1.18	0.63	0.85
1916	2.15	2.48	3.62	5.06	1961	9.84	1.18	0.63	0.84
1917	2.56	2.58	3.46	5.09	1962	9.69	1.17	0.60	0.81
1918	2.67	2.42	3.59	4.58	1963	9.70	1.16	0.59	0.81
1919	2.93	2.34	3.00	4.28	1964	9.22	1.30	0.69	0.80
1920	2.84	2.61	2.65	4.13	1965	9.37	1.24	0.57	0.76
1921	3.01	2.14	2.76	3.78	1966	9.08	1.16	0.55	0.74
1922	3.07	2.31	2.95	3.82	1967	8.86	1.10	0.52	0.73
1923	3.41	2.36	2.81	3.91	1968	8.69	1.03	0.53	0.71
1924	3.58	2.21	2.87	3.58	1969	8.11	1.01	0.52	0.72
1925	3.82	2.13	2.85	3.55	1970	7.77	1.00	0.55	0.70
1926	4.02	2.13	2.71	3.44	1971	7.75	0.93	0.51	0.71
1927	4.24	2.07	2.52	3.22	1972	7.95	0.83	0.48	0.70
1928	4.39	2.05	2.37	3.09	1973	7.92	0.77	0.42	0.71
1929	4.69	2.00	2.44	3.03	1974	7.90	0.70	0.42	0.72
1930	4.62	1.80	2.55	2.80	1975	7.73	0.63	0.36	0.72
1931	4.43	1.65	2.81	2.51	1976	7.35	0.57	0.36	0.73
1932	4.04	1.34	3.05	2.16	1977	7.21	0.54	0.31	0.74
1933	4.29	1.33	2.98	2.05	1978	6.89	0.50	0.29	0.76
1934	4.70	1.39	3.01	2.07	1979	7.00	0.43	0.24	0.77
1935	4.86	1.40	2.68	1.90	1980	6.78	0.40	0.22	0.79
1936	5.31	1.51	2.68	1.92	1981	6.52	0.39	0.22	0.77
1937	5.49	1.51	2.59	1.89	1982	6.45	0.35	0.20	0.78
1938	5.44	1.41	2.66	1.74	1983	6.19	0.34	0.19	0.77
1939	5.61	1.42	2.55	1.66	1984	5.89	0.33	0.17	0.77
1940	5.80	1.46	2.63	1.64	1985	5.90	0.30	0.15	0.76
1941	6.50	1.52	2.34	1.61	1986	5.72	0.28	0.14	0.71
1942	7.45	1.51	1.98	1.69	1987	5.50	0.25	0.13	0.68
1943	8.32	1.37	1.79	1.73	1988	5.35	0.23	0.12	0.67
1944	8.36	1.31	1.44	1.69	1989	4.93	0.23	0.11	0.66
					1990	4.76	0.21	0.10	0.66

[a] Based upon the adjusted data of Creek *et al.* (1945–1990) [*6*] and predicted values (1900–1944) obtained from inverse regression in which Creek *et al.* data were regressed on the data of Milmore and Conover [*5*].

and consumption estimates presented have both historical significance and application in epidemiological and other health-related studies.

In the current analysis, we first standardized tobacco consumption estimates obtained from two U.S. Department of Agriculture data sets to a common population base of males and females ages 18 and over. These adjusted tobacco consumption estimates, in combination with predicted estimates obtained using inverse regression, were then used to produce the continuous set of annual tobacco consumption estimates for the period 1900–1990.

Across the overlap period, the cigarette data from the two USDA reports are almost identical, although the adjusted Milmore and Conover values are slightly greater than those of Creek *et al.* The adjusted cigar figures are essentially indistinguishable over the same period. Smoking and smokeless tobacco, while showing differences after adjustment that are small in absolute terms, have percentage differences of approximately 40

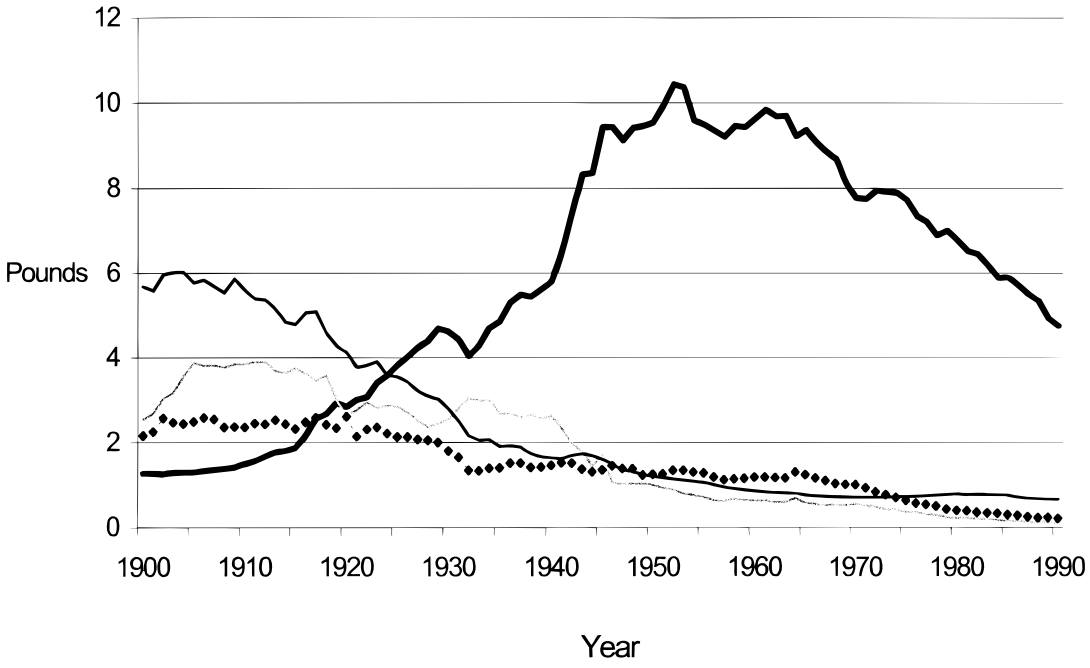

FIG. 5. Apparent per capita consumption (lb) by product type, United States: 1900–1990. Based upon the adjusted data of Creek *et al.*, (1945–1990) [*6*] and the predicted values (1990–1944) obtained from inverse regression in which Creek *et al.*, [*6*] data were regressed on the data of Milmore and Connover [*5*].

and 30%, respectively. During the overlap period, trends in all categories of tobacco consumption, whether adjusted or unadjusted, were comparable across the two USDA summaries.

Our analyses and consumption estimates are subject to a number of assumptions and limitations. Estimates of consumption are derived from disappearance data, and therefore reflect consumption intended, but not confirmed. Moreover, secular trends in tobacco consumption cannot be directly delineated in terms of age, gender, race, or birth cohort given the manner in which the tobacco use statistics were originally determined. Consequently, competing trends in any or all of these factors may be masked in the overall statistics. We have, however, provided estimates for male-only per capita consumption of cigars and smokeless tobacco, given the assumption that few women have historically used these products.

Annual population figures available through the United States Census for years prior to 1940 did not include armed forces serving overseas, while population estimates for subsequent years did include such forces. Therefore, because these population figures were used in the calculation of per capita tobacco consumption estimates, the use of figures excluding overseas armed forces would result in slight overestimates for the predicted product consumption values for the period 1900–1939.

We assume that the data quality remained constant over time for each of the two data sets. In addition, the regression analyses assume both a constancy of variance over time and the random nature of the variables being regressed [*10*]. The assumption of constant data quality can be conceptually extended to an assumption of variance constancy in that a consistent quality of the data at any point in time provides for a temporally uncorrelated error structure. The variables for yearly tobacco consumption by product type are random variables in that the data sources used by the original authors were arbitrarily selected. The validity of regression on a random variable has been justified by Brown [*10*] and Ryan [*11*].

Given the limitations and assumptions described above, the adjusted data from the two USDA summaries can be combined to describe trends for cigarette and cigar tobacco consumption over the 1900–1990 period. The adjusted figures for smoking and smokeless tobacco use also appear to be comparable; however, the values for these products should be combined with caution given their proportional discrepancy even after the presented adjustment. This argues for the use of the predicted tobacco consumption values for the years 1900 through 1944 (Table 4) when combining the tobacco data sets, particularly those for smoking and smokeless tobacco. These combined values can be further adjusted to produce consumption estimates for other population bases, as illustrated above in which cigar and smokeless

TABLE 5

Apparent Male-Only per Capita Cigar and Smokeless Tobacco Product Consumption (lb), United States: 1990–1990[a]

	Cigars	Smokeless		Cigars	Smokeless
1900	4.19	11.02	1945	2.71	3.22
1901	4.36	10.82	1946	2.92	3.02
1902	4.98	11.54	1947	2.79	2.71
1903	4.78	11.65	1948	2.79	2.67
1904	4.71	11.63	1949	2.49	2.51
1905	4.81	11.14	1950	2.53	2.43
1906	4.97	11.26	1951	2.56	2.37
1907	4.91	10.95	1952	2.72	2.32
1908	4.54	10.65	1953	2.73	2.28
1909	4.55	11.28	1954	2.65	2.20
1910	4.53	10.73	1955	2.61	2.16
1911	4.71	10.35	1956	2.41	2.06
1912	4.67	10.32	1957	2.29	1.94
1913	4.87	9.93	1958	2.34	1.86
1914	4.68	9.33	1959	2.36	1.81
1915	4.48	9.25	1960	2.42	1.75
1916	4.80	9.78	1961	2.43	1.73
1917	5.01	9.88	1962	2.41	1.67
1918	4.81	9.11	1963	2.40	1.67
1919	4.58	8.39	1964	2.69	1.65
1920	5.08	8.04	1965	2.57	1.57
1921	4.18	7.37	1966	2.41	1.54
1922	4.53	7.49	1967	2.29	1.52
1923	4.63	7.66	1968	2.14	1.48
1924	4.33	7.01	1969	2.11	1.50
1925	4.18	6.96	1970	2.09	1.46
1926	4.18	6.75	1971	1.94	1.48
1927	4.07	6.33	1972	1.73	1.46
1928	4.03	6.08	1973	1.61	1.48
1929	3.94	5.97	1974	1.46	1.51
1930	3.55	5.53	1975	1.32	1.51
1931	3.26	4.96	1976	1.19	1.53
1932	2.65	4.28	1977	1.13	1.55
1933	2.64	4.06	1978	1.05	1.59
1934	2.76	4.11	1979	0.90	1.61
1935	2.78	3.78	1980	0.84	1.65
1936	3.01	3.82	1981	0.82	1.61
1937	3.01	3.77	1982	0.73	1.63
1938	2.81	3.47	1983	0.71	1.61
1939	2.84	3.32	1984	0.69	1.61
1940	2.92	3.28	1985	0.63	1.59
1941	3.04	3.22	1986	0.58	1.48
1942	3.03	3.39	1987	0.52	1.42
1943	2.75	3.47	1988	0.48	1.40
1944	2.63	3.39	1989	0.48	1.38
			1990	0.44	1.37

[a] Based upon the adjusted data of Creek *et al.* (1945–1990) [6] and predicted values (1900–1944) obtained from inverse regression. These values were then adjusted to the male-only, 18+ years U.S. population.

tobacco consumption estimates were converted to a male-only population base.

In summary, this project adjusted for differences in two USDA tobacco consumption databases and sought to present apparent tobacco consumption estimates for the United States over the period 1900–1990. During the 9-year overlap period and for each form of tobacco examined, trends in apparent consumption were similar across the two USDA data sets. Using inverse regression and data derived from Creek *et al.* as the gold standard, predicted tobacco consumption estimates for the years 1900 through 1944 were generated. These predicted figures, when combined with the adjusted 1945–1990 data of Creek *et al.*, provide a continuous set of apparent tobacco consumption estimates for the United States during the period 1900–1990. These data have limitations, but represent a valuable historic record and may be of use in descriptive and correlational health-related studies. The methodology for calibration of these data sets may be used to further update this record with contemporary databases.

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