

Use of a Life Events Calendar Approach to Elicit Occupational History From Farmers

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Background *Precise and valid exposure assessment is generally the primary challenge in retrospective occupational epidemiology studies, particularly when the only available method for exposure characterization is a personal interview. Agricultural workers may represent a particular challenge; for example, whereas many farmers have worked from childhood at the same location, raising the same crops and animals, they may have used different equipment, chemicals, and protective gear over time. One method to assist in recall is the "life events calendar," a cognitive tool based on the subject's own life history to help anchor occupational activities in time.*

Methods *Unstructured interviews of farmers, focus groups, and pilot interviews among rural men, primarily African-Americans, were conducted to create a questionnaire for obtaining farm history information within the context of personal life events.*

Results *Farmers used both personal events and national events (as well as events relating directly to farming) to recall their activities. These subjects had extensive history of farming (10-75 years) and chemical use (median lifetime chemicals = 13).*

Conclusion *The life events calendar provided a useful tool to facilitate the recall of a lifetime of agricultural activity. Life events calendars are useful additions to the tools available for retrospective occupational exposure assessment. Am. J. Ind. Med. 34:470-476, 1998.*

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KEY WORDS: *epidemiology; exposure assessment; farming; questionnaires; survey methods*

INTRODUCTION

Epidemiologists frequently rely on self-reported occupational history for the epidemiology of chronic disease. Retrospective assessment of occupational exposure can be

difficult because of the lack of existing records of exposure, changing exposures over time within a job (e.g., chemicals and equipment used and job duties), and poor recall by study participants, particularly for events a long time ago. In chronic disease studies, such as cancer, several exposure metrics are critical to understanding the nature of the exposure disease relationship. Obtaining accurate information on time-varying exposures, exposure duration, and intensity is critical to reduce measurement error in occupational exposure assessment.

These exposure assessment issues are important in the studies of agricultural workers, both farmers and seasonal workers. Cancer epidemiology studies of farmers have reported small increases in risk of several cancers [Blair et al., 1992; Morrison et al., 1993; Zahm et al., 1993]. Some investigators, however, believe that risks are probably greater because of the crude measures of exposure used

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[Pearce and Reif, 1990]. Farming is often a lifelong occupation with people working on the same farm and growing the same crops and livestock for their entire working lives; yet exposures change over time through the introduction of new chemicals, new equipment, and new agricultural practices. Capturing these time-varying exposures is crucial to reducing measurement error in epidemiologic studies of agricultural workers. Since many individuals have some history of farmwork, especially during childhood and adolescence, the need to develop tools to assess historical agricultural exposures is considerable.

Farmers and farm workers are exposed to a variety of chemical and biological agents, primarily pesticides, fertilizers, and animal viruses. Records of chemical use and handling are often limited, although recall by farm-owner/operators is generally good, since they purchase the pesticides as well as apply them [Blair and Zahm, 1993; Blair et al. 1997]. Recall of occupational pesticide and fertilizer use is generally better than for other chemicals [Blair and Zahm, 1993; van der Gulden et al., 1993]. On the other hand, farm workers especially those involved in only one aspect of production, such as harvesting, may not know to which chemicals they have been exposed, hence the need to obtain good information on calendar period of exposure, crops worked, and geographic regions worked, to create an estimate of potential chemical exposure. Any procedure that would improve the quality of information obtained by interview regarding use and exposure to agricultural chemicals would be a distinct advantage.

Life events calendars are tools that have been used in other settings to elicit more accurate information on personal history, using milestones in each respondent's life to help them anchor life activities in time. By using easily recalled personal events, such as births, graduations, weddings, and military service, these calendars help subjects anchor events in time; calendars serve as a visual aid to help remember and reconcile dates in time. Life events calendars have been used in demography since the late 1970s to evaluate migration patterns [Landale, 1994], reproductive events [Fricke and Teachman, 1993; Wang 1996], and psychological stress [Horowitz et al., 1977]. These tools have more recently been employed in reproductive epidemiology studies to capture synthetic hormone use [Wingo et al., 1988]. Validation studies of the life events calendar for reproductive epidemiology demonstrated accuracy with respect to both years of diagnosis of reproductive events (e.g., infertility) [Wingo et al., 1988] and type of synthetic hormone use [Wingo and Lee, 1988]. In this paper we present results from an application of this strategy to obtain complete agricultural and occupational history from older rural men.

MATERIALS AND METHODS

In pilot work for a prostate cancer case-control study in rural Georgia, a questionnaire was developed to assess

agricultural and nutritional exposures among a group of predominantly African-American rural men. For the agricultural component of the questionnaire and the identification of relevant life events for rural African-American men, farm tours and focus groups were performed among men in rural Georgia. On the farm tours, unstructured interviews were conducted with farmers representing a broad spectrum of Georgia agricultural practices, including crop production (pecans, collards, corn, tobacco, grains, cotton, soybeans, peanuts), poultry production (layers, broilers, pullets), livestock production (cow-calf operations, registered herds, hogs), and other farming-related activities (syrup production, tobacco curing, green manure). Events associated with agricultural practice and personal history were noted during the course of each conversation. Nine focus groups of 4–20 rural men were asked about farming history, nutritional habits, and important life events. Subjects from half of the focus groups were specifically asked about important life events. In the remaining focus groups, moderators noted events and dates that subjects used to remember agricultural activities.

On the basis of the farm tours and focus groups, a draft questionnaire and life events calendar were developed. The interviewer-administered questionnaire was constructed to facilitate recall of difficult information, such as years of specific chemical use, by first asking about important farm events, such as tractor purchases and crops grown. Four types of life events were included on the calendar: personal life events (births, deaths, military service), farm events (tractor purchases, accidents, droughts), job history, and external events. The questionnaire was designed to encourage frequent referral to the calendar of life events during the interview. Subjects were prompted with specific chemical names to help improve the sensitivity of responses. Figure 1 presents the events included on the calendar. Items regarding agricultural practices were developed on the basis of questionnaires used by other researchers, such as the Agricultural Health Study [Hoar et al., 1986; Alavanja et al., 1996].

The life events calendar was an integral part of the interview process. At the start of the interview, the calendar was introduced to the subject. The calendar consisted of five columns: year, age, farm history, job history, and external events (Fig. 2). The interview began by recording the subject's year of birth on the calendar and then adhering an age strip to the calendar for quick conversion of the subject's age to calendar year. Throughout the interview, important events were recorded on the calendar for the subject's reference. Structured questions were used to identify life events for the calendar; additional life events suggested by the subject were added to the calendar. Copies of the life events calendar and key questions are available from the corresponding author.

Pilot interviews using the questionnaire and calendar were conducted among rural African-American men. Participants in all aspects of this work were identified by local

<u>Demographic Life Events</u>	
	Date of Birth
	Education
	Graduations
	Last year of school
	Military Service
	Marriages
	Children
<u>Farming Life Events</u>	
	Farms worked on
	Tractor
	First use
	Purchases
	Crop or Livestock Disasters
	Farm Accidents
<u>Occupational Life Events</u>	
	Job history
<u>External Events</u>	
	Presidents
	Civil Rights Events
	Football and Boxing Titles
	Major National Events

FIGURE 1. Life events included on questionnaire.

agricultural extension agents, the Federation of Southern Land Cooperatives, black churches, and other farmers. Immediately after the interview, subjects were asked about the interview format and structure, whether they would do it again, and whether there were other life events that they thought should be included. As a measure of reliability, interview subjects who reported pesticide use were contacted by phone approximately one to three weeks following the initial interview and asked additional questions about chemical use. Subjects were asked only about pesticide use; the questionnaire was not readministered. Each respondent was asked about up to six chemicals, including at least one chemical that they had not previously reported using. This information was used to assess agreement and reproducibility of responses.

RESULTS

Farm tours, consisting of both unstructured interviews and tours of the farm operation, were structured to obtain first-hand information about actual agricultural practices in Georgia, both current and historic. Sixteen active farmers (13 African-American, 3 white) aged 45–84 years participated in the tours during November 1996. Most of the men had been farmers their entire lives and most of these men held other jobs in addition to farming (e.g., agricultural agent, tax accountant, machinist, electrician, school bus

driver). The farms visited ranged in size from 130 to 2,000 acres. Crops currently or historically grown included: soybeans, peanuts, tobacco, cotton, corn, hay, wheat, collard greens, small grains, pecans, watermelons, and vegetables. Livestock raised included beef cattle, dairy cattle, hogs, and poultry (layers and broilers). Life events mentioned during the farm tour interviews included purchase of first tractor, introduction of herbicides (“Hoe-no-more”), boll weevil infestation of Georgia, father’s death, marriage, birth of children, 1996 Farm Bill, Cuban Missile Crisis, World War II, and government crop allotment activities.

Nine focus groups were conducted with 89 rural men (63 African-American, 26 white) aged 35–86 years during March and April 1997. Most of the participants had experience in farming, either as seasonal workers or as farmers. Subjects not currently living on a farm had previously lived on a farm, primarily in their childhood. Participants raised poultry, livestock, and crops. Current and historic chemical use practices were discussed at focus groups. Life events cited during the course of focus groups included WPA, the Korean and Vietnam Wars, racial tensions in the United States, marriage, birth of children, prison, and first job.

Pilot interviews were conducted in July 1997 with 20 rural African-American men. Demographic characteristics are summarized in Table I. For subjects with many years of farming experience, especially those growing commercial produce, the questionnaire took 1½–2 hr to complete. All subjects reported that they enjoyed the interview even though the administration was lengthy. Seventeen of 18 men said they found the calendar to be helpful, with 13 of 18 men indicating that they used the calendar to help them remember back to their working days. Two men did not respond to questions about the questionnaire process. Most life events questions were easily recalled by subjects, such as dates of marriages and children’s births. The interviewer also used the “external/historical” events, such as presidents, to direct the subjects to the appropriate calendar time period. A few life event questions proved difficult for subjects to answer. More than one subject “racked his brain” to try and recall years of birth for grandchildren. Farm events such as dates of tractor purchase were easily remembered. The year that a chemical was removed from the market was not as easily recalled. For example, a farmer might report the year that he first used the chemical and then would report that the last year of use was “the year that it went off the market” but could not actually remember the year.

To evaluate reproducibility, 13 of the 15 farmers who had reported using agricultural chemicals were contacted by phone 1–3 weeks after the initial interview. During the phone interview, additional information was obtained on up to six chemicals, including one that they had reported not using on their farm. All 13 farmers provided essentially the same, if not more detailed, information on chemicals used and years of use. For all chemicals mentioned, agreement

AGE	CALENDAR YEAR	LIFE EVENTS	FARM ACTIVITIES	JOBS	HISTORICAL EVENTS
16	1941		<i>First used tractor</i>		Pearl Harbor
17	1942	<i>SS graduation</i>			
18	1943	<i>ARMY</i>			
19	1944	↓			D-Day
20	1945	↓			Atomic Bomb dropped
21	1946	<i>Married</i>	<i>Bought farm</i>	<i>USPS</i>	
22	1947		<i>Grew collards for first time</i>	↓	Jackie Robinson in Major Leagues
23	1948	<i>Son born</i>			
24	1949		<i>Added land</i>		
25	1950		<i>Drought</i>		Korean War starts
26	1951	<i>Daughter born</i>			
27	1952		<i>Bought new tractor</i>		Eisenhower elected
28	1953				
29	1954				Brown vs. Topeka Board of Education

Italics indicates from Age Strip; **Bold font** indicates recorded by interviewer during interview. Complete life events calendar is included in Appendix.

FIGURE 2. Sample 15-year portion of calendar for individual born in 1925.

over this short time frame between the initial and followup interviews was 97%. Two subjects reported a different method of use (crops vs animals) for a chemical than previously reported, but the years of use agreed. During the phone interview, all subjects reiterated that they enjoyed the interview.

DISCUSSION

Life events calendars, under other names, have been used to obtain personal histories from subjects for demographic and other purposes [Casey et al. 1967; Wingo et al., 1988]. In this population, a life events calendar approach was an effective strategy to obtain agricultural information

in a structured retrospective manner. During farm tours and focus groups, all subjects spontaneously used life events, both personal and historical, to facilitate recall of farming activities. Information from the farm tours and focus groups was used in developing the procedure for the pilot interviews. Participants reported enjoyment of the interview and most remarked that the calendar helped them remember events in time.

In general, life events calendars assist both the respondent and the interviewer. For the participant, the calendar aids recall by, "priming the pump" for obtaining more distant and obscure information (e.g., When did you first use DDT?), helps anchor events in time, and enhances enjoyment of the interview process. For the interviewer, the

TABLE I. Demographic Characteristics of the 20 African-American Pilot Interview Participants in Georgia: July 1997

Age	(Range 36–86 yr)
<50 yr	4/20 men
50+ yr	16/20 men
Education	(<6 years to completion of graduate school)
Completed high school	11/20 men
Farming experience	(10–75 years)
Full-time farmers	15/20 men
Part-time farmers	2/20 men
Never farmers, rural residents	3/20 men
Farm size	(50–1,100 acres)
Median	100–200 acres
Agricultural chemical use	
Ever-use	15/20 men
No. of agricultural chemicals ever used	(4–47 chemicals)
Median	13 chemicals

calendar provides information that helps the interviewer focus the subject on a particular time period (e.g., when in the Army, during the Hoover administration). While this interview format is a useful tool, it requires extensive interviewer training to become familiar with both the questionnaire and the calendar. Additional interview time is also required to include the life events questions in the interview; however, judging from the enthusiastic response and the high quality of the data with regard to content and reproducibility, this should not be viewed as a limitation.

Selection of life events for calendar inclusion is critical to the development of a successful instrument. Events selected should be those that are memorable and easily recalled by age or calendar year to prevent wasting interview time and respondent energy on the recall of information that will not be used in analysis. After our pilot interviews, we removed the question about grandchildren's births, since this proved troublesome and time-consuming to the subjects. Ideally, events should be selected so that they are evenly spaced over a lifetime (or the time period of interest). Clustering of some important events often occurs (e.g., graduation, marriage, childbirth) and may be followed by a long lag before the next life event. We included historical and external events on our calendar to bridge these gaps in time as well as to provide an additional set of anchors for questionnaire responses.

Validation of agricultural chemical use is difficult. Frequently no records or limited records exist and therefore researchers have relied on agricultural chemical sales [Hoar et al. 1986; Blair and Zahm, 1993] or repeat interviews [van der Gulden et al., 1993] to evaluate validity of responses. We used repeat interviews in a brief format to assess reliability of questionnaire responses over a short time period of 1–3

weeks. This short time period may have resulted in better reproducibility than if the repeat interviews were conducted after a longer period after the initial interview; however, in this pilot study, a longer follow-up period was not feasible. We could not completely address accuracy, since no external records were available. However, external checks, such as the year a chemical was introduced to the market, are available to validate some responses. For example, one subject consistently reported using DDT from 1932 to 1939; however, DDT was introduced in 1945. This response was considered invalid although it is unclear whether the chemical or the time frame is incorrect. Other responses appeared consistent with historical agricultural chemical use.

This paper describes the development of life event calendars for occupational epidemiology. However, given that this study was a pilot study with only 20 interviews, further exploration of this technique is warranted to quantify the benefits with respect to data quality and to assess accuracy in a more rigorous sense. One strategy to quantify the improvement in data quality would be repeat administration of a questionnaire both with and without a life events component to the same individuals and comparing the quality and quantity of the information, especially with respect to the dates of occupational activities. While ideal, this may entail developing two questionnaires since the life events calendar is an integral component of the questionnaire structure. Future studies should evaluate the accuracy and reproducibility by use of external records, if available, and longer time periods between repeat administration. However, even with these limitations, this study has illustrated that these calendars are useful and feasible tools for obtaining occupational history information in agricultural workers.

Because epidemiologists have to rely on self-reported occupational exposure information to assess health effects, development of data acquisition instruments that facilitate and encourage accurate recall of exposures over time is critical. Life events calendars present one effective strategy to help subjects describe their exposure history accurately and easily, using memorable events as guideposts. As epidemiology moves further toward assessing early life exposures to evaluate the risks of end-of-life diseases, researchers should employ innovative tools such as life events calendars to collect information in a more precise way.

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APPENDIX: Life Events Calendar

Age	Year	Life Events	Farm Activities	Jobs	Historical Events
	1900			McKinley president	
	1901			McKinley shot, T. Roosevelt president	
	1902				
	1903			Wright Brothers Airplane	
	1904				
	1905				
	1906				
	1907			William Howard Taft elected	
	1908			Jack Johnson Wins Heavyweight Boxing Championship	
	1909				
	1910				
	1911				
	1912			Titanic Sinks, Woodrow Wilson Elected	
	1913				
	1914			World War I Begins	
	1915				
	1916				
	1917			U.S. Entry Into World War I	
	1918			WWI ends	
	1919			Chicago Race Riots, Prohibition Starts	
	1920			Warren Harding Elected	
	1921			Harlem Renaissance Begins	
	1922				
	1923			Harding dies, Coolidge president	
	1924				
	1925			Scopes Trial	
	1926				
	1927			Al Jolson in <i>The Jazz Singer</i> , Lindbergh flies to Paris	
	1928			Hoover Elected	
	1929			"Black Tuesday" - Stock Market Crash, Fox Theatre opens in Atlanta	
	1930				
	1931			The Scottsboro Boys	
	1932			FD Roosevelt Elected	
	1933			Prohibition ends	
	1934				
	1935				
	1936			Jesse Owens In Olympics	
	1937			Joe Lewis becomes heavyweight champ, Amelia Earhart disappears	
	1938				
	1939			Gone with the Wind movie released	
	1940				
	1941			Pearl Harbor Attacked; Beginning of World War II	
	1942				
	1943			University of Georgia Wins Rose Bowl	
	1944			D-Day; DDT introduced	
	1945			FDR dies, Truman president; Atomic Bomb, WWII ends	
	1946				
	1947			Jackie Robinson in Major League Baseball	
	1948			WSB-TV opens in Atlanta	
	1949				
	1950			Korean War starts	
	1951				
	1952			Eisenhower Elected	
	1953				
	1954			<i>Brown vs. Topeka Board of Education</i>	
	1955			Montgomery Bus Boycott	
	1956				
	1957			Little Rock, Arkansas School Integration	
	1958				
	1959			Alaska and Hawaii become states	
	1960			JFK Elected; W.E.B. DuBois Died	
	1961			First men in space	
	1962			Cuban Missile Crisis	
	1963			JFK Assassinated; LBJ president, MLK "I Have A Dream"; Vietnam War starts	

APPENDIX: Life Events Calendar

Age	Year	Life Events	Farm Activities	Jobs	Historical Events
	1964				Cassius Clay Defeats Sonny Liston
	1965				Malcolm X Assassinated; Watts Riots
	1966				Black Panther Party Founded
	1967				Thurgood Marshall appointed Supreme Court Justice, Muhammed Ali indicted For Refusing Military Service
	1968				MLK and Robert Kennedy Assassinated; Nixon Elected
	1969				Neil Armstrong walks on moon
	1970				Kent State Killings; Joe Frazier Becomes Boxing Champ
	1971				
	1972				Watergate, George Wallace shot
	1973				OPEC Oil Crisis, Vietnam war ends
	1974				Hank Aaron Breaks Babe Ruth's Record; Nixon Resigns, Ford president
	1975				
	1976				U.S. Bicentennial; Jimmy Carter Elected
	1977				
	1978				
	1979				Iran Hostage Crisis
	1980				Reagan Elected, UGA National Football Champions
	1981				Reagan Shot; Sandra Day O'Connor Appointed Justice
	1982				Herschel Walker wins Heisman Trophy
	1983				
	1984				Reagan re-elected
	1985				
	1986				Challenger shuttle explodes, 1st MLK holiday
	1987				
	1988				Bush Elected
	1989				Berlin Wall Torn Down
	1990				GA Tech National Football Champions
	1991				Operation Desert Storm; Clarence Thomas Hearings
	1992				Clinton Elected
	1993				
	1994				Baseball Strike
	1995				Million Man March; Oklahoma Federal Building Bombed, Braves win World Series
	1996				Summer Olympics in Atlanta

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