

SENSITIZATION AND FATIGUE IN HEALTH DIARIES

Lois M. Verbrugge, The University of Michigan

Abstract

In health diary studies, conditioning effects may occur causing trends in health indicators over the diary period. This article studies two conditioning effects: sensitization to health, and fatigue in keeping diaries. Data are from the 1978 Health In Detroit Study, in which a probability sample of white adults kept Daily Health Records for six weeks. The main results are: (1) Symptom reports drop over the diary period. This probably reflects sensitization to good health, not study fatigue. (2) Health behaviors show relatively few changes. The sharpest trends occur among men, who increase their care for symptoms. (3) Sensitization is common. It either increases or stays constant over the diary period. (4) Fatigue increases over the diary period. It causes some respondents to drop out of the study but does not influence the quality of record-keeping among people who stay. (5) Men are more sensitized by the study than women, but the sexes experience similar fatigue. (6) Perfect Cases (who did the diary task exactly as designed) are much more stable in their health reports and life circumstances than Non-Perfect Cases (who skipped days or dropped out of the study).

Introduction

Respondents in a health diary study provide information about their health over several weeks or months. (1) Participating in the study may actually influence them to change their health attitudes or behaviors. Being more aware of their health, they may perceive symptoms more readily than before, increase drug use for preventive reasons, visit a health professional sooner than they would have, or change other health habits and behaviors. This type of reaction to a study is called sensitization. (2) Participating in a diary study can also influence respondents to report health events differently as the study period lengthens. They may tire of keeping the diaries and, over time, become less thorough when filling them out. This reaction to a study is called fatigue.

Sensitization and fatigue are examples of conditioning effects--reactions to a panel study that change real-life behavior or change the reporting of behavior (even if that behavior is stable in real life). Sensitization is change in real-life health perceptions, attitudes, and behaviors. Fatigue is change in how a person reports real-life health events. If these conditioning effects are sizable, they can cause trends in rates derived from health diaries. It is generally believed that sensitization boosts reports of symptoms, disability, and medical care. In other words, it is thought that people become more aware of poor health and take more curative and preventive actions. Sensitization may be temporary (e.g. at the very beginning of the diary period) or persistent. Fatigue is thought to increase during the diary period and to reduce reports over time.

As health researchers become more interested in using health diaries, they increasingly express concern about conditioning effects. How large are they? Do they produce trends in all sorts of health indicators, or just certain ones? Are all

population groups similarly sensitized or fatigued? Since we really prefer not to have conditioning effects at all in a study, do results suggest field procedures that will reduce them?

A recent health diary study conducted in Detroit offers opportunities to study sensitization and fatigue. I shall (1) briefly review prior evidence on conditioning effects in health diary studies, (2) discuss trends in the Detroit diaries and plausible interpretations for those trends, (3) present results from an interview at the end of the study, in which diary-keepers were asked about sensitization and fatigue, (4) discuss sex differences in conditioning effects, and (5) note how people who did the diary task perfectly compare with non-perfect cases.

Prior Evidence on Conditioning Effects

Rates of health problems and health actions over time have been considered in three prior studies (Mooney, 1962; Sudman, Wilson, and Ferber, 1974; Sudman and Lannom, 1980). Three consistent results emerge: (1) Downward trends appear for most health indicators over month-long segments. (2) Drops are greatest from the first to second month, then are more gradual. (3) Researchers usually attribute the declines to fatigue--that respondents really have constant rates of illness and health behavior, but they become weary of keeping the diaries and provide less thorough reports. Occasionally, sensitization is mentioned as the cause of high first-segment rates. (Respondents may change behavior at the very beginning of the study, then return to their typical behavior.)

All of these studies use the same procedure for identifying conditioning effects: Rates are computed for segments of the diary period. They are visually examined for trends. If trends appear, they are attributed to sensitization or fatigue.

Clear determination of the reason for trends is difficult. Consider various models of sensitization and fatigue (Figure 1). Any observed trend in a health indicator is the net result of sensitization, fatigue, and possibly other time-related effects.¹ This makes hypothesis testing difficult, especially if we are interested in identifying specific patterns of sensitization and fatigue and if we want to know their relative importance. Nevertheless, it is important to know the plausible options for explaining trends and confront the issue of interpretation openly when data are in hand.

Data Source

The Health In Detroit Study was conducted in late 1978. The study population is noninstitutionalized, civilian white adults (18 years or older) residing in the Detroit metropolitan area. A multistage probability sample of households was drawn; in each household, one adult was selected as the study respondent.

Each respondent was asked to complete an Initial Interview. This face-to-face interview included questions on health and sociodemographic characteristics. Interviewed respondents were asked to complete six weeks of Daily Health Records (DHRs) required entries each day of the six week period. Each DHR had questions about symptoms and health

actions, drug use, mood, and special events of the day. The Termination Interview was conducted by telephone and included questions on health and reactions to the diary task. More details about the study design are in Verbrugge (1979, 1980).

Altogether, 714 people completed an Initial interview. Of these, 589 completed one or more weeks of DHRs; they are called Diary Starters. Perfect Cases (n=450) are the diary starters who kept six weeks of DHRs in perfect sequence. Non-Perfect Cases (n=139) are those who skipped one or more days or who dropped out of the study before completing six weeks of DHRs. Altogether, Diary Starters produced 23,526 days of data.

Aggregate Results--Trends in DHR Reports

Weekly rates for all questions in the Daily Health Records were computed and plotted for three groups (Diary Starters, Perfect Cases, Non-Perfect Cases). Regression lines were estimated for the six weekly points. Analyses were also done separately for Men and Women, to see if trends vary by sex.

Table 1 summarizes regression for various DHR variables. (Each rate is expressed as an average per individual. It is the total number of events divided by the number of days with nonmissing data for the sample.)

(1) Over the six weeks, people report that they feel better, have fewer symptomatic days and fewer symptoms, have a more positive mood, and have fewer eventful days. The weekly rates show a steady downward drift which is captured well by linear regression. This probably does not indicate fatigue. Respondents overtly report that they are feeling better over time. Fewer symptomatic days and fewer symptoms are a natural reflection of this. The declines may actually be due to sensitization--the persistent focus on health making people recognize their good health. Although prior studies have assumed that sensitization increases awareness of negative aspects of health, it is certainly possible for studies to increase awareness of positive ones.

(2) Overall rates of restricted activity decline. But several types of restricted activity (bed days and work loss) increase. In addition, curative care from doctors and dentists increases over the diary period. These results suggest sensitization--an increased propensity to take major health actions when feeling ill.

Note that no clear trends appear for other curative actions: rates of cutting down chores and errands, giving up other planned activities, or talking with friends about symptoms.

(3) Preventive medical care and preventive drug use show no clear patterns over time.

(4) Overall drug use also has no clear trend. One specific type of drug (maintenance drugs for asymptomatic conditions) does increase over time.

Combining Detroit results with the three previous studies, these changes occur in a 4-6 week health diary period: (1) Illness rates drop 15-30%. Although specific indicators vary greatly across the studies, all show declines in this range. (2) Declines are greatest for minor illnesses. (3) Rates of restricted activity, bed disability, and medical care drop in the Mooney and Sudman studies. For Health In Detroit, restricted activity drops but bed days and medical care rise. (4) Trends in health behaviors are

less sharp than trends in symptom reports. [A table is available from the author showing percentages changes in rates for the four studies.]

Individual-Level Results--The Termination Interview

Analysis of aggregate rates is an indirect approach to studying conditioning effects. A very different approach is possible if diary-keepers are asked directly about changes in their health perceptions and behavior, and about reactions to the diary task. Direct questions about sensitization and fatigue can be analyzed at individual-level. The Termination Interview of the Health In Detroit Study provides intriguing evidence about conditioning effects. All Diary Starters had a Termination Interview, whether they dropped out of the study or not.

Sensitization. Over half (57.3%) of the Diary Starters say they were more aware of their health problems during the study than before it. Very few (6.4%) say their health behavior changed. (See Table 2.) This mirrors the aggregate analysis, which shows stronger trends for health status variables than health action variables.

With respect to the timing of sensitization, most sensitized people (72.9%) say it occurred throughout the diary period. Some (21.3%) say it was just at the beginning of the diary period; few (6.7%) say it was only at the end of the period.

The Termination Interview asked only about perception of health problems. Unfortunately, there was no question about increased awareness of good health. In the Health In Detroit Study, sensitization may have been a very general phenomenon--a keener awareness of physical feelings, both good and bad. Daily record keeping by the sampled person him/herself could produce greater awareness of both aspects of health.

The Termination Interview data also allow indirect measures of sensitization for each individual. Six questions were repeated in both the Initial Interview and Termination Interview. They cover a range of concepts about illness perception and behavior, and they were expected to be quite stable over time in a control population. Thus, changes might reflect sensitization over the diary period.

Strictly defined, stability means that identical answers appear in both interviews. By this criterion, roughly half the respondents have stable attitudes. Relaxing the definition to allow adjacent answers (small shifts) as well as identical ones, stability increases. It ranges from 64.8% to 95.0% for the six items. Stability is greater for symptom perception than for attitudes about health care.

Table 3 shows the six repeated items and their aggregate distributions for the interviews. Sensitization implies that people perceive symptoms more readily and tend to take more health actions than before. We would expect self-rated health to worsen, awareness of variability in health to increase, propensities to restrict activity and seek medical care to rise, and preventive orientations to increase. These hypotheses were tested by comparing the percents of respondents who shifted in negative directions vs. those who shifted in positive ones. Only two hypotheses are confirmed: People whose health rating changed tend to view their health worse at the end of the study. And over half of the people whose preventive attitudes change say they are taking better

care of their health at the end of the study. (But the results for restricted activity and medical care go strikingly against the hypotheses. People become less enthusiastic about these actions over the study period. I suspect these shifts are largely artifacts of a social desirability effect. In the face-to-face interview, respondents may have felt that favorable views were "proper." Later, during the Termination Interview, their truer feelings emerged.)

In summary, I believe much more is learned from the direct questions about sensitization than from the repeated items. I shall soon compare the individual-level results with the aggregate ones.

Fatigue. Few respondents (18.7%) say they tired of keeping the Daily Health Records. When asked about the timing of fatigue, most say it increased as the diary period lengthened.

Summary. Based on respondents' own answers, sensitization is more common than fatigue.

[Differentials in sensitization and fatigue by social, demographic, and health statuses are discussed in the full text, available from the author.]

Men and Women

How do men and women differ in sensitization to health problems and health behavior? How do they differ in fatigue?

Although more women report being sensitized to their health problems (54.7% vs. 45.3%), the aggregate analyses show very similar trends for health status indicators. The similarities are so strong that one is led to suspect that both sexes experience similar sensitization but women may be more aware of it.

The same percent of men and women say they changed their typical health behaviors (6.8% , 6.2%). But the aggregate analyses provide strong evidence that men were more sensitized to change their health behaviors. They are mainly responsible for the increased rates of bed days, work loss days, and curative medical/dental care reported above. Women show much gentler trends or no clear pattern for these DHR items.

Overall, the results suggest that study participation sensitized men to take more curative actions than before. Women were less affected by participating.

There is no significant difference between men and women in feeling fatigued (19.7%, 17.9%). Aggregate analyses also show no evidence of any sex difference in fatigue in keeping the Daily Health Records.

Perfect and Non-Perfect Cases

The health of Non-Perfect Cases is worse than for Perfect Cases, and it is also less stable over time.

The aggregate analyses of trends reveal many differences between the groups. (1) Comparing averages for the whole diary period, Non-Perfect respondents have more symptoms, especially serious ones. Their rates of restricted activity (esp. chores and work loss), curative medical care, and curative drug use are higher. They take maintenance drugs and preventive drugs less often. Their moods are worse. (2) Over time, both Perfect and Non-Perfect respondents experience improved health and mood. The trends are sharper (i.e., the improvement is greater) for Non-Perfect Cases. (3) Non-Perfect Cases also show sharp trends for

most health behavior items. Restricted activity, lay conversation, and drug use all decline for them, but show no clear trends for Perfect Cases.

In the Termination Interview, more Non-Perfect respondents say their awareness of health problems was heightened during the study, than Perfect Cases (53.2% vs. 42.5%). Non-Perfect Cases were also a bit more likely to say they handled health problems differently (9.4%, 5.6%). They are much more likely to report fatigue in keeping DHRs (30.7%, 15.2%). Other items in the Termination Interview show that the diary task was more onerous for Non-Perfect respondents. They spent more time filling out the DHR each day. They missed a day more often and were more likely to leave it blank rather than fill it in later. (This concurs with their Non-Perfect status--having some blank days in their diary period, or dropping out of the study.) They were more likely to provide proxy data by having someone else fill out a DHR for them sometimes.

Less stable health and failure to fulfill the diary task are not isolated features of Non-Perfect Cases' lives. Life simply has more changes and disruptions of all kinds for them. In the Initial Interview, they report more major life events in the preceding year. In the Termination Interview, they report more important events during the diary period. Whether we look at interview or DHR data, their health is always worse than Perfect Cases. Non-Perfect respondents tend to be younger adults, be divorced/separated or never-married, have low incomes and low education, and be the sole adult in their household. These sociodemographic characteristics reflect disruptions or difficult life situations.

For these people, a task requiring daily record-keeping for six weeks is very difficult. The results suggest that diary studies might develop special procedures to help young adults, nonmarried people, and those with recent life changes to complete the diary task.

Discussion and Conclusion

Consider the usual view of sensitization and fatigue in health diary studies: Sensitized people become more aware of symptoms and discomforts during the study, and they take more curative health actions. As they tire of filling out records, people become careless and fail to record some events. Now consider a different view: Sensitized people become more aware of both positive and negative aspects of their health during the study. Both curative and preventive actions increase. People who tire of filling out records drop out of the study. Those who remain may experience fatigue but they continue to report fully, believing in the study's value.

The Health In Detroit data do not support the first view. The evidence favors the second one:

(1) Declines in symptom rates over time appear to be real. People actually feel better as the diary period continues. Thus, conditioning effects may be present but they are more likely sensitization (to good health) than study fatigue.²

(2) Changes in health behavior are much more modest, and they occur mainly among symptomatic men who increase their curative care. This smaller change in health behavior compared to health status parallels results of other studies.

(3) Fatigue is present for relatively few respondents. In the Health In Detroit Study,

Figure 1. Models of Sensitization and Fatigue in Health Diaries

---- is hypothesized pattern for diary data

— is typical level for population

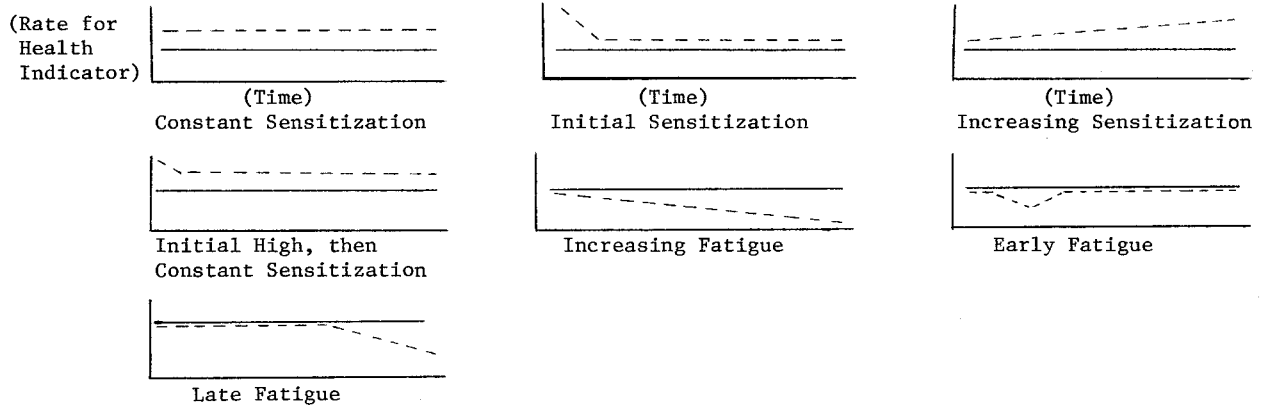


Table 1. Trends in Health Variables Across Six Weeks, All Diary Starters^a

(\bar{y} = overall average. Pattern = based on visual scan of rates. L = linear, CV = concave, CX = convex, C = other curvilinear, N = no pattern. b = regression slope for the six weekly rates. R^2 = correlation coefficient. * means $P < .05$, ** means $P < .01$. Critical value for $P < .05$ is .658; for $P < .01$, .841).

	\bar{y}	Pat	b	R^2		\bar{y}	Pat	b	R^2
<u>General Health</u>					<u>Lay Communication</u>				
How R feels physically today (1 = terrible, 10 = wonderful)	7.64	L	.056	.983**	If R talked with anyone besides doctor about today's symptoms (Mean no. of lay conversation days per week)	0.18	L	-.010	.943**
<u>Symptoms</u>					<u>Preventive Care</u>				
If R has any symptoms or discomforts today (Mean no. of symptomatic days per week)	0.37	L	-.018	.892**	If R visited or telephoned a clinic, doctor, or dentist's office, or hospital today for any reason besides symptoms (Mean no. preventive activity days per week)	0.04	N	-.001	.355
Total no. of symptoms or discomforts today (Mean no. of symptoms per week)	0.52	L	-.026	.854**	<u>Drug Use</u>				
No. "very serious"	0.03	C	-.002	.329	If R took any pills, medicines, or treatments for health today (Mean no. drug use days per week)	0.54	CV	-.004	.369
No. "somewhat serious"	0.14	N	-.004	.480	Total no. of drugs taken (Mean no. drugs per week)	1.24	N	.003	.223
No. "not very serious"	0.34	L	-.020	.782*	No. curative drugs	0.33	N	-.003	.269
<u>Restricted Activity</u>					No. drugs for asymptomatic conditions	0.31	L	.021	.915**
If R cut down on things he/she usually does because of today's symptoms (Mean no. of rest. activ. days/week)	0.09	CV	-.007	.781*	No. preventive drugs	0.56	C	.002	.073
Total no. of activity restrictions (Mean no. of restrictions per week)	0.16	CV	-.005	.234	No. other drugs	0.08	C	-.001	.168
No. bed days	0.02	C	.001	.188	<u>Mood</u>				
No. days cut down on household chores/errands	0.07	CV	-.004	.596	How R's spirits were today (1 = terrible, 10 = wonderful)	7.63	L	.063	.960**
No. work-loss days	0.02	C	.001	.067	<u>Life Events</u>				
No. school-loss days	0.01	C	.000	.344	If anything happened for better or worse to make today different than usual (Mean no. eventful days/week)	0.38	L	-.012	.856**
No. days cut down on other planned activities	0.04	C	-.003	.506	Total no. special events (Mean no. events per week)	0.48	L	-.011	.574
<u>Curative Medical/Dental Care</u>									
If R sought medical/dental help about today's symptoms (Mean no. activities per week)	0.02	C	.000	.017					
Total no. of medical/dental activities (Mean no. activities per week)	0.02	C	.000	.016					

a All rates refer to All Days as the denominator. Rates referring to Symptomatic Days were also analysed (for Symptoms, Restricted Activity, Curative Care, Lay Communication). These results are available on request. Regression results for Men and Women, and for Perfect and Non-Perfect Cases are also available.

b The overall mean does not equal the sum for the four types of drugs. (1) Type was coded for only the first 5 drugs listed. The total on a given day could exceed 5. (2) Respondents could say a drug served more than one function (i.e., multiple types).

Table 2. Direct Questions About Sensitization and Fatigue from the Termination Interview
(n=574 Diary Starters who completed a Termination Interview)

Symptom Perception

"Did participating in this study make you notice your health problems more than before?"	Yes	57.3%
	No	42.7
(If Yes): "Were you more aware of them all during the six weeks or just part of that time?"	All during the six weeks	72.9%
(n=292)	Part of the time	27.1

Propensity to Take Curative Actions

"While participating in this study, did you handle your health problems differently than you usually would? For example, were you more likely to visit a doctor, cut down your activities, or take medications?"	Yes	6.4%
	No	93.6

Fatigue

"Sometimes people get a little tired of filling out the daily records and are not as careful or complete as usual. Did anything like this happen to you?"		
(If Yes): "What happened?" (n=101)	Filled it out faster	13.9%
	Skipped days or questions	17.8
	Had someone fill it out for me	2.0
	Didn't think about answer as much	4.0
	Got bored with DHRs	49.4
	Other answer	12.9
(If Yes): "When was that?" (n=94)	Beginning of diary period	6.4%
	End of diary period	14.8
	All or most weeks	12.8
	Other	39.3
	General frequency stated (e.g., often)	10.6
	Time of day or week	4.3
	Holiday or season	1.1
	Other personal events	4.3
	Other	6.4

Table 3. Indirect Measures of Sensitization based on Items in the Initial Interview
Which Were Repeated in the Termination Interview
(n=574 Diary Starters who completed a Termination Interview)

		<u>Initial</u>	<u>Termination</u>	<u>Change (Term-Initial)</u>
"Would you say your health in general is excellent, good, fair, or poor?"	1 Excellent	39.2%	32.3%	13.4% neg, 21.0% pos
	2 Good	45.8	50.6	
	4 Fair	12.0	13.6	Weakly confirmed
	5 Poor	3.0	3.5	
"Compared to other people your age, how often do you get sick?"	1 A lot more often	1.6%	1.1%	22.1% neg, 24.3% pos
	2 Somewhat more often	4.7	4.6	
	3 About the same	21.2	21.7	Not confirmed
	4 Somewhat less often	37.9	36.4	
	5 A lot less often	34.6	36.2	
"For some people, how they feel physically varies a lot from day to day; other people feel about the same each day. How about you?"	1 Varies a lot	6.5%	4.7%	17.9% neg, 23.8% pos
	2 Varies somewhat	22.3	18.2	
	4 Varies only a little	55.0	61.2	Not confirmed
	5 Varies not at all	16.2	15.9	
"When you are feeling ill, how much do you think it helps you to get better if you cut down on your usual activities--for example, if you stay home, stay in bed, and so on?"	1 Helps a lot	38.0%	26.6%	17.8% neg, 30.8% pos
	2 Helps somewhat	34.0	27.1	
	4 Helps only a little	16.9	31.0	Not confirmed
	5 Helps not at all	11.1	15.3	
"How true is the following statement for you: 'If I wait long enough, I can get over most any illness without getting medical aid.'"	1 Very true	12.9%	17.8%	41.0% neg, 18.6% pos
	2 Somewhat true	33.8	46.4	
	4 Not too true	29.1	20.8	Not confirmed
	5 Not true at all	24.2	15.0	
"Now to sum up, how good a job do you think you are doing in taking care of your health?"	1 Excellent job	12.6%	16.4%	21.4% neg, 17.1% pos
	2 Good job	59.9	56.4	
	4 Fair job	24.0	22.5	Weakly confirmed
	5 Poor job	3.5	4.7	

severe fatigue seems to have produced time gaps (skipped days that were never filled in later) and study attrition (dropping out of the study) rather than poorer quality DHRs. The study design called for frequent contact with respondents, especially those having trouble with the diary task. This alleviated fatigue for many respondents; "very fatigued" people had few options except to drop out of the study. Thus, fatigue had little effect on the quality of the filled-out records.

(4) Sensitization is a more prevalent and powerful phenomenon in this health diary study than fatigue. Sensitization influenced mainly health perceptions, and sometimes health behaviors.

(5) The aggregate analyses suggest that sensitization increases over the diary period. The Termination Interview indicates more constant sensitization, and increasing fatigue. These match three models in Figure 1: Increasing Sensitization, Constant Sensitization, and Increasing Fatigue. It is disappointing that the aggregate and individual-level analyses suggest different models of sensitization. Consistency in the trends and in respondent statements would be more scientifically pleasing.

(6) Men appear more sensitized by the study, mainly with respect to health actions. They increase their bed days, work loss, and curative medical care more than women do.

(7) People in changeable or difficult life situations had more trouble with the diary task. In particular, young adults 18-34, divorced/separated people and never-married ones, low income or low education respondents, and people with major life events in the past year tended to be Non-Perfect Cases. Non-Perfect Cases reported more sensitization and fatigue during the study. Their health was worse before the diary period and throughout it. And their health was less stable than for Perfect Cases during the study. Field efforts might be aimed at the sociodemographic groups noted to help maintain their motivation during a diary study.

Some readers may argue that six weeks is too short for conditioning effects to appear. This may be true for health diary studies which require infrequent record keeping (e.g., only when a person feels ill) and allow proxy response. But the Health In Detroit Study required daily entry by the sample person him/herself. This is a demanding task, and it kept health on a respondent's mind for a long time. In this type of study design, six weeks is probably ample time for conditioning effects to appear.

The Health In Detroit results differ from previous studies (which find declining rates for most health indicators and usually attribute trends to fatigue). The study design may partly

account for the results: Self-reporting meant that good aspects of health as well as bad ones could be assessed. (In other studies, proxy respondents were allowed. Proxies tend to see only negative health events of people for whom they report.) Constant contact by study staff kept respondents well-motivated. Those who stayed in the study produced full reports and did not let fatigue influence diary-keeping.

The Health In Detroit results have interesting implications for health diary studies. If diary-keepers are constantly encouraged by study staff, fatigue may cause some sample attrition but it need not compromise the quality of diary reports. (And attrition itself can be small. The Health In Detroit Study has a very high completion rate for diary-keepers, when compared with other mailback studies. See Verbrugge, 1980.) Sensitization is much more difficult to control, but in this study it appears to have boosted feelings of good health among respondents as well as greater awareness of illness and injury.

Footnotes

1. Examples of other time-related events which may cause trends or may influence rates for specific time points are: season, holidays, mass media, political events, and sample attrition.
2. One other reason for improved health in the DHRs must be considered: social desirability. It is possible that respondents wanted to appear more healthy over time and (unconsciously) reported better moods, fewer symptoms, and better physical feelings over the diary period.

References

- Mooney, H.W. Methodology in Two California Health 1962 Surveys. Public Health Monograph No. 70. PHS Pub. No. 942. Washington, D.C. Public Health Service.
- Sudman, S., W. Wilson, and R. Ferber. The Cost-1974 Effectiveness of Using the Diary as an Instrument for Collecting Health Data in Household Surveys. Report to the Bureau of Health Services Research and Evaluation. Urbana: Survey Research Laboratory, University of Illinois.
- Sudman, S. and L.B. Lannom. A Comparison of 1979 Alternative Panel Procedures for Obtaining Health Data. Urbana: Survey Research Laboratory, University of Illinois (Forthcoming as a Research Report of the Natl. Center for Health Services Research.)
- Verbrugge, L.M. "Female illness rates and illness 1979 behavior: Testing hypotheses about sex differences in health." *Women and Health*, 4(1), Spring, 61-79.
- Verbrugge, L.M. "Health diaries." *Medical Care*, 1980 18(1), January, 73-95.