Can Patient Self-Management Explain the Health Gradient? Goldman and Smith (2002) Revisited[*]

Sudeshna Maitra

Dept. of Economics
York University
1118 Vari Hall,
4700 Keele Street
Toronto ON M3J 1P3
Email: smaitra@econ.yorku.ca
Phone: (416) 736 2100 ext. 33233
Fax: (416) 736 5987

October 2006

[*] I would like to thank Anne Case, Joshua Goldstein and Adriana Lleras-Muney for their many useful comments on this research. All remaining errors are my own.

Can Patient Self-Management Explain the Health Gradient? Goldman and Smith (2002) Revisited

October 2006

ABSTRACT

Using the Health and Retirement Study, Goldman and Smith (2002) ["Can patient self-management help explain the SES health gradient?", *PNAS*, **99**(16), 10929-34] find that poor self-management of health has significant effects on health deterioration and that such poor behavior is less likely to occur among the more educated. They conclude that self-management of health is an explanation for the much-documented positive correlation between education and health outcomes—the education-health gradient. In this paper, I show, using the same data, that controlling for poor self-management behavior has little impact on the education-health gradient, raising doubt about whether such behavior can be said to explain the gradient at all. I also show that Goldman and Smith's results—both the effect of adherence on health and that of education on adherence—depend on how poor self-maintenance behavior is defined. Lastly, using another component of socioeconomic status, viz. resources, I find that a gradient in resources and health does exist, but this too is not impacted much by self-maintenance. These findings cast doubt on whether self-management can explain the gradient in health and socioeconomic status, when the latter is represented by education or resources.

Keywords: Health gradient, Education, Patient self-management

JEL classifications: I12, I21

Abbreviations used: SES, socioeconomic status; HRS, Health and Retirement Study

Introduction

There is a large literature documenting the positive association between socioeconomic status (SES) and health outcomes—the SES-health gradient (1, 2). The association has been documented for different components of SES, such as education, income and wealth, and also for different measures of health outcomes, such as mortality, morbidity and self-reported health. Also, there is evidence that the direction of causality can run both from SES to health (3, 4) and from health to SES (5). However, the mechanisms that drive the relationship are still not perfectly understood. Some of the many arguments that have been forwarded point to differences in access to quality healthcare, or differences in the proclivity for risky personal behavior (e.g. smoking) as potential mechanisms driving the association. But these explanations do not account for the entire gradient and are therefore seen as incomplete (2, 6).

Goldman and Smith (6) forward a different explanation for why socioeconomic status—specifically, education—may be associated with better health outcomes. They argue that one explanation for the education-health gradient could be the positive effect of schooling on self-management of a condition, after it has been detected. Education is a good proxy for the ability to comprehend and execute complex treatment regimes and also the ability to internalize the future outcomes of poor self-management behavior. Hence schooling could have a positive effect on health, generating an education-health gradient.

In this paper, I revisit the analysis of Goldman and Smith (6) and point to three difficulties in interpreting their results as evidence that self-management drives the gradient. Later, I examine another component of SES, viz. resources, to investigate if a gradient in *resources* and health exists and if self-management can explain a part of it. While, in general, the mechanisms that drive the associations between health and different components of SES need not be the same, it is plausible that the availability of resources could enhance good self-management by permitting adherence to expensive and complex treatment regimens. It seems a natural extension of Goldman and Smith's analysis, therefore, to test their claim for this component of SES. While my findings confirm the existence of a gradient in resources and health, they fail to provide conclusive evidence that self-management plays an important role in explaining this gradient either.

Discussion

In their paper, Goldman and Smith use three datasets and two conditions (diabetes and HIV) to assert that adherence behavior is an important component of the education-health gradient. One of their approaches involves a study of diabetic patients from the Health and Retirement Study (HRS). Using the first four waves of the HRS, Goldman and Smith employ a two-step argument to demonstrate that self-maintenance explains the gradient. First, they show that poor adherence to treatment regimens by diabetic patients increases the likelihood of their reporting a deterioration in health (as measured by self-reported health status) between the first and fourth waves. Next, they demonstrate that such 'poor' adherence behavior is significantly less likely to occur among more educated respondents. Put together, the results of the two steps imply that education is likely to reduce the type of self-management behavior that is associated with a worsening of health over time. Hence, self-management can be argued to be one of the mechanisms that drive the education-health gradient.

There are three main difficulties in interpreting Goldman and Smith's results using the HRS. First, the primary step in establishing that self-management explains the education-health gradient would be to demonstrate that the correlation between education and health improvement is reduced when poor self-management behavior is controlled for in the analysis. While the two-step analysis of Goldman and Smith implicitly suggests that this is the case, there is no explicit representation of how much the education-health gradient is altered, if at all, when poor self-management behavior is introduced. I find, using the same data as Goldman and Smith, that the gradient in education and health is hardly impacted when poor self-management behavior is controlled for in the analysis. This raises doubt about the validity of this mechanism in explaining the association.

Second, Goldman and Smith define poor adherence behavior as any one or more of three practices observed in patients—if a patient on any treatment regimen stops completely (practice A), if she switches from one treatment regimen to another before returning to the original regimen (practice B) or if she adds a second treatment over time to the first (practice C). For Goldman and Smith's two-step argument to work, the type of poor practice that is associated with a worsening of health over time must also be the type of practice that is observed less in more educated patients. Since poor behavior as defined by Goldman and Smith, is a combination of three practices A, B and C, it is not clear if the above criterion is met. To see this point, consider two hypothetical practices X and Y that may be considered to represent poor self-management. If X is associated with worsening health but not with education, and Y with education but not with health, then taken individually neither behavior X nor Y would satisfy the two-step criterion of Goldman and Smith (i.e. be significantly correlated both with change in health and with education). Hence, if poor behavior were defined by X alone or Y alone, there would be no evidence that it plays a role in explaining the education-health gradient. However, if bad behavior were defined as a combination of X or Y (i.e. any one or more of X or Y), then this definition of poor behavior could meet the two-step criterion and such behavior would be (mis)interpreted as explaining the education-health gradient.

In the HRS data used by Goldman and Smith, I find that the practices that have a deteriorative effect on health are not the ones that schooling is significantly more likely to prevent. Specifically, I find that practices A, B and C, when considered individually, do not meet the two-step criterion of Goldman and Smith and hence do not explain the education-health gradient. Moreover, I show that for the two-step criterion to be met, poor behavior has to be defined as certain combinations of practices A, B and C, demonstrating again a break in the link of the two-way argument.

The third difficulty in interpreting Goldman and Smith's results is that while practices A, B and C may indeed indicate poor adherence to a treatment pattern, they could also be driven by the progress of the condition over time. It is possible, for instance, that the practices that appear to demonstrate poor self-management actually reflect an adherence to more complex treatment regimens, prescribed in response to the worsening health of the patient. The health of a patient would be worse, for instance, if she had other co-morbidities such as hypertension or heart disease. The prescribed treatment for such patients could be more complex so as to take into account its effect on these other conditions as well. Also, certain medications for diabetes may become ineffective upon prolonged use[*], which may lead to a switch in the treatment regimen being prescribed. In such an event, the health of the patient—as determined by the duration and severity of her condition—would again guide the treatment prescribed to her, which in turn would drive her observed self-

[*] See http://www.umm.edu/diabetes-info/treatmen.htm for an outline of traditional treatments for diabetes.

management behavior. In other words, poor self-management behavior, as defined, could be an effect and not just a cause of poor health. This raises concern that the associations obtained by Goldman and Smith do not stem from the mechanism they attempt to establish, viz. an effect of education *on health* via better self-management.

The results described above fail to provide conclusive evidence on whether self management of conditions does indeed drive the education-health gradient. In a subsequent of this paper, I turn to another measure of socioeconomic status, viz. resources, to see if a resource-health gradient exists and if self-management can explain some part of it. Using net worth of the household in the baseline wave as a measure of resource availability, I find that a higher net worth is significantly more likely to be associated with health improvement over time. Hence a resource-health gradient does exist among respondents in the data. However, as before, I find that controlling for poor self-management has little or no impact on the magnitude of this gradient, casting doubt on whether self-management can explain the resource-health gradient either.

Can we then reject the hypothesis that self-management could have a significant role to play in driving the SES-health gradient? This is not the case. My findings point to some difficulties in interpreting a set of results obtained by Goldman and Smith as evidence in favor of self-management. But my results do not, in themselves, reject the possibility that self-management could indeed be an important mechanism behind the gradient. This paper therefore opens up the debate about the significance of this mechanism in driving the gradient, and points to the need for future research to return to this issue for a resolution of the question.

Methods and Results

Replication of Goldman and Smith (2002). In this section, I describe the data and replicate the results of Goldman and Smith (6) using their definition of poor self-maintenance behavior.

The sample is drawn from the first four waves of the Health and Retirement Study (HRS), a nationally representative longitudinal survey of 12,650 respondents born between 1931 and 1941 and their spouses. The respondents are followed over time at two-year intervals, beginning in 1992. Here I use the first four waves of the survey, viz. those conducted in 1992, 1994, 1996 and 1998. The sample I use includes 862 respondents who have reported being diagnosed with diabetes in the first wave and who are followed in each wave till 1998[†].

Table 1 describes the pattern of adherence behavior among respondents in the sample. The first point to note is that each of practices A and B (see description in Table 1), individually accounts for only 7% of the observations, while practice C constitutes as much as 17%. Moreover, whereas Goldman and Smith's definition of poor behavior A/B/C is demonstrated by 23.5% of the respondents, A/C is practised by 23.1%, B/C by 19% and A/B by only 12%. This suggests that most of the respondents who engage in practice B also demonstrate practices A or C, hence the proportion of individuals exhibiting A/C is not much different from those who exhibit A/B/C. These figures also indicate that only a small proportion of individuals engage in practices A and C jointly[‡]. This, coupled with the fact that there are more respondents who engage in practice C than in practice A, explains why the proportion of respondents who exhibit A/B (i.e. no C) is so much lower than the proportion of patients who engage in B/C (i.e. no A). Put together, these findings suggest that practice C may be more important than the others in driving Goldman and Smith's results, both because it individually accounts for the largest proportion of observations and also because removing it from the definition of poor behavior drastically reduces the proportion of observations.

A closer look at practice C, however, raises the concern that it may be the *effect* of poor health rather than the cause. Recall that C is defined as the practice of adding a second treatment to the one the patient was already undergoing. But this practice may plausibly represent adherence to a new treatment regimen prescribed by the doctor in response to health conditions. As discussed earlier, certain medications for diabetes may become ineffective upon prolonged use. In such an event, the health of the patient—as determined by the duration and severity of her condition—would guide the treatment prescribed to her, which in turn would drive her observed self-management behavior. Also, diabetes is known to be associated in many cases with co-morbidities such as high blood pressure, stroke and heart conditions, and increases the risk of some of these conditions in patients (7). The prescribed treatment could, therefore, be a reflection of the complexity of the patient's health condition (8) as determined by the presence of co-morbidities and their implications regarding the severity and duration of diabetes. Hence, what appears to be poor self-management practice could in fact represent adherence to more complex treatment regimens that are prescribed to patients with worse health. Moreover, this direction of causation—from poor health to poor behavior—is potentially plausible for each of the three practices included in Goldman and Smith's definition of poor self-management behavior.

Table 2 takes a look at respondents' health in the baseline wave and their self-maintenance behavior (A/B/C) over time. The patterns clearly indicate that poor self-maintenance is more likely to occur among respondents with worse health in the baseline wave and is consistent with the view that causation could run from poor health to poor behavior. 25% of individuals who been diagnosed with hypertension, a lung condition (other than asthma), cancer, stroke, a heart condition, a psychiatric condition or arthritis in the baseline wave engage in poor self-management behavior over time, compared with only 16% of those without any of these conditions. Similarly, 27% of respondents who report symptoms such as back, foot, bladder or stomach problems or high cholesterol or asthma in 1992 also engage in poor self-maintenance behavior in the next four waves, while only 13% of individuals without these problems do so. Again, 27% of respondents who find at least one of seventeen Activities of Daily Living hard to perform demonstrate poor behavior, while only 19% of the others do so. This pattern is repeated for the body mass index (normal and below versus above-normal) and depression index as well.

These findings present a fundamental difficulty in interpreting Goldman and Smith's results, since if poor self-management behavior were indeed a response to rather than a cause of poor health, then their interpretation of the two-step criterion—viz. that

[†] Individuals who report in wave 4 that they have never been diagnosed with diabetes – but report diabetes in wave 1 – are dropped. This is the closest approximation to Goldman and Smith's (6) sample where n = 869. Results are similar even when these individuals are included or when individuals with conflicting reports in the middle waves are dropped.

[‡] The proportion of respondents who engage in both A and C is simply the sum of proportions who engage in A and C individually, less the proportion who demonstrate behavior A/C. This is obtained to be 0.4%.

education improves health by facilitating better self-management –would no longer be valid.

Tables 3 to 6 replicate the results obtained by Goldman and Smith (6). The following discussion outlines the broad patterns observed in these tables, which are consistent with the findings of Goldman and Smith.

Table 3 presents the baseline self-reported health status of all respondents in 1992 as well as those who reported diabetes. The education-health gradient is immediately evident from this table. About 30% of respondents who have not completed high school education report excellent or very good health while almost three quarters of college educated respondents report the same. Similarly, 38% of respondents who have not completed high school education report fair or poor health, whereas only 6% of college-educated respondents do the same. For diabetics, bad health is more common but the gradient persists. 69% percent of the least educated category report fair or poor health whereas only 25% of the most educated do the same.

Table 4 reports on the patterns of treatment among diabetic patients at the baseline survey. Like Goldman and Smith, I find a negative gradient between education and switching behavior. For example, 47% of the least educated category report switching in oral medication while 29% of the most educated category do so. For insulin use, 24% of the least educated category are known to switch treatments, whereas only 13% of the most-educated category do so.

Table 5 reports results from ordered probits of change in self-reported health between the first and fourth waves, on education and other controls. As expected, higher education is associated with an improvement in health over the waves (see column (1)). In particular, respondents in two categories of education—12 years and 13-15 years—are significantly more likely to report an improvement in health, compared with respondents who have not completed high school (0-11 years). The negative coefficients on education categories represent the education-health gradient. (Note that the dependent variable is +1 for a deterioration of health, 0 for no change and -1 for an improvement in health over the waves.)

Column (2) of Table 5 introduces poor self-maintenance behavior as an independent variable. A patient is classified as engaging in 'poor' self-management behavior if she stops treatment completely after reporting undergoing some form of treatment in any wave (practice A), if she switches from one treatment regimen to another and then returns to the original regimen (practice B), or if she adds a second treatment to the one she was already undergoing (practice C), e.g. adding insulin to a regimen of oral medication. This definition of poor behavior is used by Goldman and Smith and like them, I find that poor behavior increases the likelihood of a worsening of health across the waves. This is the first step in the two-step argument of Goldman and Smith.

However, including poor self-maintenance behavior does not appear to have much impact on the education-health gradient. The size of the coefficients on two categories of education (12 years and 16+ years) is slightly reduced (by 2% and 6.5% respectively) and that on the third category (13-15 years) increases very slightly (by 1%), after including poor self-management behavior. This finding casts doubt on the hypothesis that poor self-management behavior *explains* the gradient, since its inclusion does not appear to diminish the magnitude of the gradient by much.

Table 6 reports results from probits of poor self-management behavior (A/B/C) on education and other controls. I find that college-educated respondents (16+ years) have a significantly lower probability of engaging in poor adherence behavior (as defined above) compared with those who have not completed high school. As before, this result is also consistent with the findings of Goldman and Smith and constitutes the second step in their two-step argument.

The results of Tables 5 and 6 taken together, indicate that poor self-management behavior is associated with a worsening of health, and that higher education lowers the likelihood of such behavior. Goldman and Smith interpret this two-step result as evidence that self-management of health explains the education-health gradient.

In the next section, I demonstrate that the result obtained above depends on the way in which poor self-management behavior is defined.

Other definitions of 'poor' self-management behavior. In this section, I shall repeat the regressions in Tables 5 and 6 by redefining poor behavior to include practices A, B and C individually and in various possible combinations. The results are presented in Tables 7 and 8.

The first point to note from Table 7 is that controlling for poor behavior does not reduce the education-health gradient by much (compare with column 1 of Table 5), even when poor behavior is broken down into different components. Hence, this finding—which mirrors a similar result from the previous section—is robust to the manner in which poor self-management behavior is defined. As before, this result casts doubt on whether self-management does indeed play a noteworthy role in explaining the education-health gradient.

The results of Tables 7 and 8 point to several interesting facts, even if the two-step argument of Goldman and Smith is employed to make a case for self-management. The findings for behaviors B and C in Table 7 (Panel A), for instance, are very similar to the result obtained in Table 5 (column (2)).Both these behaviors are likely to be associated with a worsening of health over time, and the effects are significant. Table 7 also reveals that behavior A does not have a significant impact on health over time. However, Table 8 (Panel A) shows that it is behavior *A* that is significantly (negatively) associated with education and not behaviors B or C. In other words, behaviors B and C are more likely to have an adverse impact on health but education does not appear to reduce the likelihood of these behaviors. Education does diminish the likelihood of behavior A but this behavior has no significant impact on health! When self-management practices are considered individually, therefore, the link is broken in the two-step argument constructed by Goldman and Smith to demonstrate that the association between education and health is driven by self-maintenance.

In Panel B of Tables 7 and 8, I report the results from conducting the same analysis but using combinations of practices A to C. The results from Table 7 (Panel B) suggest that behavior C is a necessary and sufficient component of any combination of practices that has a significant effect on health. This follows from the fact that behaviors A/C, B/C and A/B/C are significantly associated with a worsening of health over time whereas behavior A/B is not. Moreover, from Table 8 (Panel B), it is clear that each of these behaviors is also significantly (negatively) associated with education (the coefficient on at least one category of education is significant for each). Hence, the two-step criterion is satisfied and the gradient appears to be explained for these combinations of practices—A/C, B/C and A/B/C.

But note the implications of the above discussion. As noted earlier, any behavior that includes C as a component (viz. C, A/C, B/C and A/B/C) is significantly associated with a worsening of health over time (Table 7, Panels A and B). However, C alone is not significantly associated with education (Table 8, Panel A) so that a *combination* of practices including C is required for there to be a significant relationship between education and such behavior.

This points again to the break in the two-step argument of Goldman and Smith.

It might appear premature, however, to reject Goldman and Smith's argument on the basis of the above alone, since an insufficient number of observations for each individual practice could be driving this pattern. But even if we choose to focus on the patterns of behavior that do explain the gradient, there remains the difficulty of ascertaining if these may indeed be interpreted as 'poor' behavior or if they are merely the result of poor health. Note that practice C is a necessary component of all behaviors that explain the gradient by the two-step criterion, viz. A/C, B/C and A/B/C (recall that A, B and A/B do not satisfy this criterion). But as discussed earlier, it is quite plausible that practice C, instead of representing poor self-management, reflects an adherence to complex treatment regimens, prescribed in response to the worsening health of the patient. If this is the case, then the two-step criterion would no longer be consistent with the interpretation that education improves health by enhancing better self-management of conditions.

Does poor self-management explain the *resource*-health gradient? Results from the previous section suggest that poor self-management behavior may not play an important role in explaining the education-health gradient. In this section I turn to another measure of socioeconomic status, resource availability, to see if a *resource*-health gradient exists and is explained by poor self-management behavior.

As a measure of resource availability, I use the net worth of the household in 1992, computed as the difference between the value of household assets and debts. Data on net worth are provided in the first wave of the HRS.

Column (1) in Table 9 demonstrates the existence of a resource-health gradient, using the net worth of the household in 1992. Compared with households that lie in the bottom third of the distribution of net worth, respondents from households with higher net worth are significantly more likely to report an improvement in health over time. Moreover, the effect of resources on health improvement is higher for individuals in the top third of the distribution than those in the middle third. It is important to note, however, that the resource-health gradient thus obtained may be driven both by the effect of resources on health and that of health on resources. Unlike years of schooling, which for this sample of older individuals, is not influenced by health, resources may suffer a decline due to high medical expenditures or labor supply decisions associated with failing health (7). For the purpose of this section, therefore, the resource-health gradient will represent the sum total of both the effect of health on resources as well as that of resources on health.

The results of Table 9 do not provide much support for the view that the resource-health gradient is explained by poor self-management. Regardless of the definition of poor self-management behavior, controlling for it does not appear to reduce the size of the coefficients on resources by much. Similar results (not reported here) are obtained for other measures of resource availability as well. Hence, there does not seem to be evidence that self-management plays a noteworthy role in determining the *resource*-health gradient either.

Does self-management play *no* role at all? The results presented above appear to cast doubt on the claim that self-management plays an important role in explaining the SES-health gradient, at least for the two measures of SES used here. However, it is important to remember that these findings only point to drawbacks in interpreting a set of results obtained by Goldman and Smith, as evidence in favor of self-management. They are not sufficient to reject the potential importance of patient self-management as a mechanism behind the gradient. Whether patient self-management really explains the gradient and to what extent, are questions that are still open to debate and that future research must attempt to answer.

References

1. Adler, N. et al (1994) *American Psychologist*, **49**(1), 15-24
2. Smith, James P. (1999) *Journal of Economic Perspectives*, **13**(2), 145-166
3. Case, Anne (2004) in *Perspectives on the Economics of Aging*, ed. Wise, D. (University of Chicago Press, Chicago), 287-311
4. Lleras-Muney, Adriana (2005) *Review of Economic Studies*, **72**(1), 189-221
5. Thomas, Duncan et al. "Iron deficiency and the well-being of older adults," November 2003, mimeo, UCLA, available at http://emlab.berkeley.edu/users/webfac/emiguel/e271_s04/friedman.pdf
6. Goldman, Dana P. and Smith, James P. (2002) *Proceedings of the National Academy of Science*, **99**(16), 10929-34
7. Fillenbaum et al (2000) *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, **55**(2), M84-9.
8. Winocaur, P.H. (2002) *British Medical Journal*, **324**, 1577-1580

Table 1. Self-management among respondents in the sample (n = 862)

Poor Adherence Behavior:	Mean	Std. Dev.
A (stops treatment completely after having started on something)	0.068	0.253
B (switches treatment regimens, then returns to original regimen)	0.072	0.259
C (adds a second treatment to the first)	0.167	0.373
A/B/C	0.235	0.425
A/B	0.119	0.325
A/C	0.231	0.422
B/C	0.193	0.395

Respondents are diabetics in the baseline wave (1992)

X/Y represents an indicator for engaging in at least one of the practices X or Y.

Table 2. Baseline health conditions and poor self-maintenance behavior (A/B/C) for sample respondents (n = 862)

	1992 Comorbidities - 1[a]		1992 Comorbidities - 2[b]	
A/B/C	None	At least one	None	At least one
No	83.9	75.3	86.9	73.2
Yes	16.1	24.7	13.1	26.8

	ADL (1992)[c]		BMI (1992)	
A/B/C	None	At least one	Below 25	Above 25
No	81.4	72.8	79.2	76.1
Yes	18.6	27.2	20.8	23.9

	Depression (1992)[d]	
A/B/C	None	At least one
No	82.4	74.1
Yes	17.6	25.9

[a] Includes hypertension, cancer, chronic lung condition (except asthma), heart condition, stroke, arthritis and psychiatric condition.

[b] Includes asthma, high cholesterol and problems relating to back, feet, bladder, stomach.

[c] Respondent finds at least one of 17 activities of daily living very difficult to perform (or "can't do" them).

[d] Respondent admits to at least one of 14 "feelings" of depression.

Table 3. Self-Reported Health Status (SRHS) for all HRS respondents and those with diabetes at baseline

	Years of schooling			
Baseline health status	0-11	12	13-15	16+
All HRS respondents, tracked in waves 1-4				
Excellent	11.4	22.8	28.8	38.0
Very Good	19.0	31.5	33.6	35.1
Good	31.8	28.9	26.3	20.8
Fair	23.8	12.1	8.6	4.4
Poor	14.0	4.6	2.7	1.7
Diabetics in wave 1, tracked in waves 1-4				
Excellent	1.2	3.4	7.8	7.5
Very Good	9.0	13.1	21.3	29.9
Good	20.5	38.1	34.8	37.4
Fair	39.9	30.2	26.2	16.8
Poor	29.5	15.3	9.9	8.4

Columns add to 100 in each panel.
Replication of Goldman and Smith (2002).

Table 4. Patterns of treatment among diabetics at baseline

Years of Schooling	Always	Never	Switches
Takes oral medication			
0-11	31.5	21.1	47.4
12	31.7	32.1	36.2
13-15	27.0	35.5	37.6
16+	34.6	36.4	29.0
Uses insulin			
0-11	24.3	52.0	23.7
12	23.5	57.1	19.4
13-15	14.2	61.0	24.8
16+	24.3	67.0	13.1

Rows add to 100 in each panel.
Replication of Goldman and Smith (2002).

Table 5. Predictors of a change in general health status between Wave 1 and Wave 4 (Ordered Probits)

	Without Poor Behavior	With Poor Behavior
	(1)	(2)
Years of schooling (excluded, 0-11 years)		
12 yrs	-0.186*	-0.181*
	(0.101)	(0.101)
13-15 yrs	-0.269**	-0.273**
	(0.126)	(0.127)
16+ yrs	-0.199	-0.186
	(0.144)	(0.144)
Poor self-maintenance behavior (A/B/C)	-	0.282**
		(0.098)
Female	-0.095	-0.103
	(0.084)	(0.085)
Black	0.259***	0.251***
	(0.096)	(0.096)
Hispanic	0.357***	0.374***
	(0.13)	(0.131)

Replication of Goldman and Smith (2002).
Standard errors in parentheses.
* significant at 10% ** significant at 5% *** significant at 1%
Full model results are shown in the appendix (n = 862).

Table 6. Predictors of poor self-maintenance behavior, A/B/C (Probits)

	Coefficient	Std. Error
Years of schooling (excluded, 0-11 years)		
12 years	-0.186	(0.117)
13-15 years	-0.148	(0.145)
16+ years	-0.363**	(0.171)
Female	0.126	(0.106)
Black	0.148	(0.112)
Hispanic	-0.118	(0.158)
Married waves 1 and 4	-0.045	(0.118)
Married wave 1 and not married wave 4	0.614**	(0.307)
Not married wave 1 and married wave 4	-0.057	(0.414)
Female, married wave 1 and not married wave 4	-0.536	(0.372)

* significant at 10% ** significant at 5% *** significant at 1%
Full model results are shown in the appendix (n = 862).

Table 7. Predictors of a change in general health status using alternative definitions of 'poor' self-maintenance behavior

	Panel A: Individual behaviors		
	A	B	C
Poor self-maintenance behavior (as per column header)	-0.07	0.381**	0.408***
	(0.16)	(0.16)	(0.112)
Yrs of Schooling (excluded, 0-11 yrs)			
12 years	-0.186*	-0.183*	-0.182*
	(0.101)	(0.101)	(0.101)
13-15 years	-0.267**	-0.259**	-0.270**
	(0.126)	(0.127)	(0.127)
16+ years	-0.2	-0.191	-0.199
	(0.144)	(0.144)	(0.144)

	Panel B: Combinations of behaviors			
	A/B	A/C	B/C	A/B/C
Poor self-maintenance behavior (as per column header)	0.17	0.282***	0.388***	0.282***
	(0.127)	(0.099)	(0.106)	(0.098)
Yrs of Schooling (excluded, 0-11 yrs)				
12 years	-0.186*	-0.183*	-0.177*	-0.181*
	(0.101)	(0.101)	(0.101)	(0.101)
13-15 years	-0.270**	-0.274**	-0.266**	-0.273**
	(0.126)	(0.127)	(0.127)	(0.127)
16+ years	-0.193	-0.189	-0.19	-0.186
	(0.144)	(0.144)	(0.144)	(0.144)

Standard errors in parentheses.
* significant at 10% ** significant at 5% *** significant at 1%
Full model results are shown in the appendix (n = 862).

Table 8. Predictors of self-maintenance behavior, using alternative definitions of 'poor' behavior

	Panel A: Individual behaviors		
	A	B	C
Yrs of Schooling (excluded, 0-11 yrs)			
12 years	-0.042	-0.11	-0.171
	(0.162)	(0.16)	(0.128)
13-15 years	0.018	-0.239	-0.203
	(0.196)	(0.213)	(0.16)
16+ years	-0.513*	-0.242	-0.165
	(0.283)	(0.243)	(0.18)
Chi-square for Education Dummies	3.62	1.84	2.62
(Prob > Chi-square)	(0.305)	(0.607)	(0.455)

	Panel B: Combinations of behaviors			
	A/B	A/C	B/C	A/B/C
Education (excluded, 0-11 years)				
12 years	-0.07	-0.173	-0.206*	-0.186
	(0.138)	(0.118)	(0.124)	(0.117)
13-15 years	-0.077	-0.178	-0.199	-0.148
	(0.171)	(0.146)	(0.153)	(0.145)
16+ years	-0.354	-0.352**	-0.246	-0.363**
	(0.215)	(0.171)	(0.175)	(0.171)
Chi-square for Education Dummies	2.7	5.09	3.95	5.4
(Prob > Chi-square)	(0.44)	(0.165)	(0.267)	(0.145)

Standard errors in parentheses.
* significant at 10% ** significant at 5% *** significant at 1%
Full results are shown in the appendix (n = 862).

Table 9: Predictors of a change in general health status: the resource-health gradient

	Without Poor Behavior	Panel A: Individual Behaviors		
	(1)	A	B	C
Net Worth in 1992 (Excluded: Bottom Third of Distribution, Less than $26,500)				
Middle Third: $26,500 to $108,730	-0.215**	-0.213**	-0.206**	-0.199*
	(0.102)	(0.102)	(0.102)	(0.103)
Top Third: Above $108,730	-0.467***	-0.471***	-0.450***	-0.450***
	(0.112)	(0.112)	(0.112)	(0.112)
Poor Self-Maintenance Behavior (as in column header)	-	-0.109	0.355**	0.398***
		(0.16)	(0.162)	(0.113)
	Panel B: Combinations of Behaviors			
	A/B	A/C	B/C	A/B/C
Net Worth in 1992 (Excluded: Bottom Third of Distribution, Less than $26,500)				
Middle Third: $26,500 to $108,730	-0.212**	-0.207**	-0.201*	-0.205**
	(0.102)	(0.103)	(0.103)	(0.103)
Top Third: Above $108,730	-0.459***	-0.446***	-0.441***	-0.444***
	(0.112)	(0.112)	(0.112)	(0.112)
Poor Self-Maintenance Behavior (as in column header)	0.137	0.258***	0.371***	0.257***
	(0.128)	(0.1)	(0.107)	(0.099)

Standard errors in parentheses.
* significant at 10% ** significant at 5% *** significant at 1%
Full model results are shown in the appendix (n = 858)