

The Effect of Performance Pay on U.S. Worker's Physical and Emotional Health: Evidence and Implications for Gig Work

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Final report to the US Department of Labor for grant EO-30271-17-60-5-25: The Effect of Performance Pay on U.S. Workers' Physical and Emotional Health

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Abstract

Background. Evidence suggests that performance-based pay schemes common to the growing gig economy may result in poor health outcomes. However, cross-sector evidence of its long-term effects on U.S. workers is lacking. This paper represents the first longitudinal cross-sector analysis relating health outcomes to pay type in U.S. workers. We evaluate health outcomes for workers subject to incentivized compensation to better understand the effects and implications of modern day performance and piece rate pay in the growing gig economy sector.

Methods. Data from six survey waves of the 1979 National Longitudinal Survey of Youth collected between 1988 and 2000 are used in a random effects logit model to predict self-reported health limitations related to performance-based pay, controlling for worker, work environment, time and location trends. Additional cross-sectional analysis of specific health outcomes reported at the workers' 40th birthday were explored as a hypothesis-generating exercise to identify specific endpoints that might be driving observed effects.

Results. Pay tied to performance in current or prior periods increased the odds of self-reported health limitations compared to salaried work (Odds Ratio (OR) 1.3-2.2). These effects are elevated for the sub-groups of low-wage (OR 1.39-1.43), female (OR 1.33-1.96), and non-white workers (OR 1.41-2.16) compared to their peers. Exploratory analyses identified a number of specific health endpoints that might be driving the overall negative relationship.

Conclusions. The results suggest that performance-based pay designed to promote efficiency may have important negative implications for worker health, especially for the most vulnerable members of the U.S. workforce such as women, minority, and low-income workers. Given the growing popularity of these pay structures to the gig economy, more research is needed to determine if the practice is justified from both a public health and long-term profit perspective.

INTRODUCTION

Adam Smith surmised at the start of the industrial revolution in *Wealth of Nations* (1776) that ‘Workmen...when they are liberally paid by the piece, are very apt to overwork themselves, and to ruin their health and constitution in a few years.’¹ Key evidence has surfaced since Smith’s time to support his early conjecture of the negative health impacts of tying worker compensation directly to their productivity. Studies have linked incentivized pay schemes to increased accident and injury risk,²⁻⁶ as well as poor health outcomes in specific populations or industries. For example, negative effects of pay by the piece have been observed on body mass index in Filipino farmers,⁷ absenteeism in German steel plant workers,⁸ depression and somatic complaints in Israeli garment workers,⁹ elevated heart rates in Canadian loggers,¹⁰ and medication usage in Canadian garment workers.¹¹ Pay for performance has also been linked to increased worker compensation costs in a U.S. shoe manufacturing firm,¹² negative physical and emotional health outcomes in Vietnamese garment workers,¹³ and negative self-reported health outcomes,³ back problems and repetitive stress injuries¹⁴ in cross-industry analyses of British workers. This paper explores the effect of pay structure on the U.S. workforce, utilizing both broad and narrow definitions of incentive pay to identify an impact on worker health.

Despite recent declines in U.S. manufacturing where piece rate was particularly popular,¹⁵ incentivized pay schemes are becoming increasingly relevant to the ‘on-demand’ service sector, otherwise known as the ‘gig’ economy. Gig work has been described as the division of paid effort into smaller components, offered to independent contractors with low barriers to entry via a web-based platform.¹⁶ Independent contractors such as Uber drivers are paid based on the number of rides, with no guaranteed salary or benefits regardless of the hours worked. Gig work represents a modern-day example of piece rate, with worker pay tied

explicitly to effort. The primary difference is that the effort is measured in service provided as opposed to the traditional piece rate classification based on the production unit in manufacturing.

Gig work represents a relatively new transition in the U.S. economy, but compensating workers directly for effort has been studied for some time. Evidence of the ill-effects of gig economy work on health and well-being is limited but growing.¹⁷ In this paper, we evaluate health outcomes for workers subject to incentivized compensation in an effort to better understand the effects and implications of modern day performance and piece rate pay in the growing gig economy sector.

METHODS

We explore the relationship between exposure to performance and piece rate pay and self-reported worker health outcomes. The dataset used in the analysis is part of a large cohort study of U.S. workers maintained by the Bureau of Labor Statistics – the National Longitudinal Survey of Youth 1979 (NLSY79). NLSY79 follows approximately 10,000 US workers born between 1957 and 1964, with follow-up available initially on an annual basis and later bi-annually, from 1979 to 2014. However, data on pay type is limited to six of those survey waves (1988, 1989, 1990, 1996, 1998, and 2000). Although these data are more limited than the full NLSY panel, they provide a unique series of repeated observations on individual workers, and the longitudinal nature of the series allows us to identify any cumulative effects that may exacerbate over time.

Table 1 summarizes the data available during the six survey waves of NLSY79 with pay type information. ‘Performance pay’ is defined as all performance-based compensation, including piece rate, bonus pay, commissions, stock options, tips, etc. that tie worker pay in some way to performance. ‘Piece rate’ is a more limited category where worker pay is directly

tied to the unit of production or service, which is analogous to how the gig economy typically compensates contract workers for direct effort. Nearly 25% of the sampled workforce reported being compensated with performance pay as an average across all participants and survey years, while 69% of surveyed workers reported at least one performance pay job by 2000. More limited exposure to piece rate pay is observed, with an average of nearly 4% of the total jobs reported by workers over the sample period paid this way. However, 16% of the surveyed workers reported at least one piece rate pay job during the entirety of the follow-up period, which is similar to previously cited estimates of the prevalence of piece rate pay in U.S. workers over this time period² as well as the number of U.S. workers primarily doing independent work.¹⁶

The data describing worker health outcomes in NLSY79 varies depending on the survey year, as the health section of the questionnaire was adapted over time to reflect respondents' varying life cycle stages. The most complete match to the six survey waves of pay type data is represented by the variable 'Health limitation.' For this variable, workers self-report whether they have any health condition or circumstance that limits their activities, work or otherwise. Like all variables in the NLSY data series, Health limitations is subject to self-reporting bias; however, there is no way to determine the extent to which this may be impacting the associations reported in this paper. Additional data on specific physical and emotional health outcomes are only available as a cross-section, collected when the worker turns 40 years of age.

Other important control variables identified in Table 1 include key worker demographics such as income, race, education, sex, age, and health insurance status. Additional work-related covariates are noted for workers in the manufacturing sector where piece rate is more common, self-employed, tenure at job, and hours worked per week, as evidence suggests that workers paid through incentive-based systems tend to work more hours per week than salaried workers.³

Finally, important health behavior variables such as diet, exercise, and smoking are available only in a single survey wave. In these cases, the time invariant effects are included in the model to control for individual worker habits and behaviors impacting the likelihood of health limitations, and like a previous work² are assumed to be constant across the survey waves. Given the limitations of the data series, there is no way to determine the extent to which changing health behaviors and attitudes towards health are impacting the associations observed in this paper.

Statistical model

A random effects logit model was used to predict the presence of self-reported worker health limitations using the xtlogit command in STATA 15 (College Station, TX) based on the following Equation 1:

$$\text{Equation 1: } I_{it} = \alpha_0 + \beta X_{it} + \delta W_{it} + \phi \text{PayType} + \sigma_i + \pi_k + \kappa_t + \varepsilon_{it}$$

where i and t index workers and survey waves, and I is the presence of a health limitation (0=No, 1=Yes). Descriptive statistics of the variables used to identify Equation 1 are provided in Table 1. X and W control for heterogeneity across workers and work environments, respectively.

PayType is defined as current or previously reported performance or piece rate pay in a given survey wave, which allows us to identify the cumulative effect on health limitations; σ , π and κ control for worker, region (determined by Census division), and survey wave effects, respectively. Worker-level random effects control for unobserved characteristics such as risk preferences that might impact the sorting of workers into piece rate and performance pay jobs; errors are clustered by worker to control for repeated observations within the panel series. An advantage of the random effects model is that it allows us to control for time invariant

demographic characteristics directly, providing an estimate of their effects on the dependent variable.

Additionally, the logit model described above was adapted and run separately by specific sub-groups, which focused on low-income vs high income, non-white vs white and female vs male workers, to explicitly identify whether the modeled relationships were significantly different for susceptible sub-groups of workers. The low-income cut-off is calculated based on the definition of the U.S. Department of Health and Human Services as 150% of the federal poverty level. Finally, we conducted an exploratory analysis of the 40th birthday cross-sectional panel to identify potential health endpoints for future study that might be driving the overall health effects observed in the longitudinal series, identifying statistical significance with chi-square and t-tests where appropriate.

RESULTS

Tables 2 and 3 estimate the cumulative effect of performance and piece rate pay, respectively, on worker health limitations over time. All coefficients are represented as odds ratios to facilitate interpretation and comparisons. Performance pay, which is the more broadly defined incentive pay category that includes bonus and tips, as well as the more narrowly defined piece rate, is statistically significant in the full model. Workers exposed to performance pay report health limitations at 1.3 higher odds than salaried workers. Exploring the impact of performance pay by susceptible sub-groups, low-wage (OR=1.4), female (OR=1.3), and non-white (OR=1.4) workers all show statistically significant negative effects on health, while the effects outlined in the full model fall away for higher income, male, and white workers. Older age and higher rates of self-employment significantly increase the odds of reporting a health limitation, as well as workers

who reported being on a diet or smoking. Variables that significantly decrease the odds of reporting a health condition include increased tenure at job, greater hours worked per week (likely an artifact of the healthy worker effect), higher education levels, and regular exercise.

Piece rate pay, which represents worker compensation directly tied to the unit of service or output, is not statistically significant in the full model that includes all worker sub-groups. However, when broken down by sub-group, the odds of reporting a health limitation are significantly greater for low-wage (OR=1.4), women (OR=2.0), and non-white (OR=2.2) workers compared to salaried workers. These effects are not significant for the alternative categories of higher income, men, and white workers. Similar to the performance pay results, age significantly increases the odds of reporting a health limitation, as well as dieters and smokers. Health promoting effects are observed for tenure, hours worked per week, and more educated workers.

The results outlined in Tables 2 and 3 attempt to identify the cumulative effects of pay type where health in a given survey wave is linked to the existence of performance or piece rate pay in any previous survey wave. The results of additional specifications linking the health outcome to piece rate or performance pay in a particular wave irrespective of previous periods yielded similar odds ratios but were not measurably different (did not reach the conventional level of statistical significance).

Table 4 presents the results of a series of comparison tests on specific health conditions using the cross-sectional panel of data observed during the survey period closest to the worker's 40th birthday. At the respondent's point of middle age, having been paid piece rate was statistically and significantly associated with poor health outcomes, including the specific conditions of asthma, back and leg problems, high cholesterol, depression and anxiety, frequent

trouble sleeping, and hardening of the arteries, among other negative health conditions.

Although not possible with the existing dataset, additional research is needed to control for extraneous factors that might be impacting the relationship between pay type and these health conditions. However, the initial exploratory results identify a number of useful avenues of future research in that regard.

DISCUSSION

The evidence presented in this paper suggests that performance and piece rate pay may increase the odds of health limitations compared to salaried work. Interestingly, the deleterious effects of incentive pay are not born uniformly across workers, and instead appear to disproportionately impact low-wage, female, and non-white workers. Notably, non-white piece rate workers had the highest odds of reporting a health limitation compared to their salaried peers across the analyses (OR=2.2) followed closely by female workers (OR=2.0), while the negative health effects of performance and piece rate pay on health disappear for the alternative groups of higher wage, white, and male workers. More research is needed to understand these differential effects, which could be the result of many factors beyond wage incentives, including but not limited to current and historical discrimination practices in hiring and employment.

This paper is the first to attempt a large-scale longitudinal and cross-sector analysis of U.S. workers, linking health outcomes to performance and piece rate pay. It builds on previous efforts to use the NLSY1979 cohort to identify a statistically significant impact of pay type on worker accident and injury risk.² Similar international studies identified a statistically significant relationship between performance pay and piece rate on worker health across sectors in the U.K.;^{3,14} however, these results may have limited applicability in the U.S. context because of

differences in underlying worker protection and labor laws. The current paper corroborates the U.K. findings for U.S. workers, with poorer health outcomes reported for performance and piece rate workers compared to salaried workers, especially for the low-wage, female, and minority workforce. The elevated risk to vulnerable worker groups is not surprising, as previous literature linked piece rate pay to increased risk of occupational accidents and injuries for blue-collar workers² and women.⁴ More recent evidence specific to the gig economy finds growing inequality among the bottom 80% of the distribution of workers in these jobs,¹⁷ as well as a gender gap in earnings favoring men.¹⁶

Although incentivized pay systems are generally understood to increase worker productivity,¹⁸⁻²¹ the impact on overall profits for business operations that pays workers in this way remains a topic of debate.^{12,22} Evidence suggests that gains in productivity may be offset by maladaptive worker behaviors, including those detrimental to health that ultimately increase operating costs and lower business profits.^{2,12,23} This unintended consequence makes intuitive sense, as worker behaviors and activities that are financially rewarded, such as increased output, take precedence over those that are not rewarded, in this case worker health and safety. This paper extends the argument one step further to suggest that poor health outcomes linked to performance and piece rate might further erode a company's bottom line, as health limitations are likely to result in lower quality work, increased absenteeism, and higher health care costs.²⁻¹⁴ The negative effect of performance and piece rate pay may be particularly harmful to the profits of companies staffed with the vulnerable worker groups highlighted in the current analysis.

Policy Implications

The real-world implications of this work are two-fold. First, the results provide suggestive evidence of increased health care costs of workers subject to performance pay by way of declining health compared to salaried peers. Although performance pay schemes are generally understood to be revenue generating, the impact on profits that include costs related to worker health, performance, and absenteeism deserve further review. Incentive-based pay schemes such as performance and piece rate pay should be evaluated in terms of their health limiting effects on the workforce and not just by increased efficiency measures, particularly as it relates to the growing gig economy. Further research is needed to determine best practices around performance pay and profits as performance pay may represent a lose-lose scenario for both workers and businesses. A second implication of this work is the need for more research to support better-informed policies around vulnerable segments of workers in the gig and related performance pay sectors. The evidence suggests that the negative health effects of performance pay are born primarily by vulnerable workers, including women, minority, and the working poor. There is a need to better understand why these workers suffer worse health outcomes than their white, male, higher income peers, so that government policy might better target the underlying causes behind the differential health outcomes.

Limitations

The NLSY1979 provides a large and representative sample of US workers over time; however, the data available on performance and piece rate pay are limited to six years of follow-up and are missing for some surveyed workers. Additionally, key health behavior variables are available only in a single survey wave; given the data limitations it is impossible to determine the impact

of the time invariant assumption of health behaviors on the results. Additionally, all NLSY data are self-reported and therefore subject to an unknown degree of self-reporting bias. Initially the project planned to also explore the second NLSY cohort that was initiated in 1997, but due to severe data limitations described in the Appendix, this second analysis was not completed.

Although these data were not sufficiently robust to identify causal effects of performance pay on health, the analyses highlighted statistically significant associations between performance and piece rate pay over-time on worker health limitations, most notably among the susceptible sub-group categories.

Conclusion

This paper is the first to explore the effects of pay type on worker health outcomes in a large and representative longitudinal and cross-sector panel of the U.S. workforce. The results suggest that worker health suffers as a result of performance and piece rate pay compared to salaried work, especially for vulnerable sub-groups of the U.S. workforce. In fact, the results show little to no impact of performance and piece rate pay for the non-susceptible segments of the working population, with the entirety of the effect born by the vulnerable workforce of low-income, female, and non-white workers. Further research is needed to identify the reason behind the differential effects, and to explore the negative health implications as they relate directly to the growing gig economy and contract workforce in the U.S.

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Table 1: Summary statistics for NLSY1979 survey waves 1988, 1989, 1990, 1996, 1998, and 2000

Variables	Definition	Categories	N	Mean	Median	S.D.
<u>Primary dependent variable</u>						
Health limitation	Worker has health limitation(s)	0=No, 1=Yes	55,700	0.07	0	0.26
<u>Primary independent variables</u>						
Performance pay	Any reported job is performance pay	0=No, 1=Yes	48,303	0.25	0	0.43
Piece rate	Any reported job is piece rate	0=No, 1=Yes	43,085	0.04	0	0.19
<u>Additional covariates</u>						
Hours	Hours per week in primary job	Continuous	49,463	40.17	40	11.94
Male	Worker is male	0=No, 1=Yes	76,116	0.51	1	0.50
Manufacturing	Has any job in the manuf. industry	0=No, 1=Yes	49,407	0.20	0	0.40
Low wage worker	Wage < 145% of fed. minimum	0=No, 1=Yes	48,062	0.63	1	0.48
Family income	Real after-tax annual family income	1979 U.S. dollars	39,764	23,097	16,731	45,754
Education	Highest grade completed	Count	56,342	12.86	12	2.45
Non-white	Individual is Black or Hispanic	0=No, 1=Yes	76,116	0.41	0	0.49
Tenure at primary job	Years of tenure at primary job	Continuous	47,505	4.07	2	4.52
Health insurance	Covered by health insurance plan	0=No, 1=Yes	46,055	0.81	1	0.40
Age	Age at interview	Continuous	56,573	31.95	31	5.07
Self-employed	Self-employed in any job	0=No, 1=Yes	49,393	0.10	0	0.30
<u>Cross-sectional variables¹</u>						
Diet	Trying to lose weight (self-reported 2002)	0=No, 1=Yes	46,314	0.43	0	0.50
Exercise	Engages in exercise at least three days per week (self-reported 2002)	0=No, 1=Yes	43,794	0.63	1	0.23
Smoker	Currently smokes at least one cigarette per day (self-reported 1998)	0=No, 1=Yes	47,658	0.32	0	0.47

¹Variables only available as a cross-sectional panel reported in the single survey wave as noted in parenthesis. All other summary variables reported in the table represent the six survey waves referenced in the title.

Data Source: NLSY1979

Table 2: Cumulative Effect of Performance Pay on the Odds of Worker Health Limitations

Variable	Full model	Not Low-wage ¹	Low-wage	Male	Female	White	Non-white
Performance Pay	1.34** (1.07-1.66)	1.09 (0.70-1.70)	1.39** (1.11-1.73)	1.37 (0.97-1.95)	1.33* (1.01-1.75)	1.27 (0.94-1.73)	1.41* (1.04-1.91)
Health Insurance	0.83 (0.66-1.06)	0.59 (0.29-1.20)	1.04 (0.83-1.30)	0.73 (0.51-1.04)	0.94 (0.68-1.31)	0.76 (0.54-1.07)	0.93 (0.67-1.29)
Age	1.08** (1.02-1.13)	1.08 (0.98-1.20)	1.09** (1.04-1.15)	1.14** (1.05-1.23)	1.03 (0.96-1.10)	1.10** (1.02-1.18)	1.06 (0.98-1.13)
Tenure at primary job	0.96** (0.93-0.98)	1.00 (0.96-1.04)	0.96** (0.93-0.98)	0.97 (0.93-1.00)	0.95** (0.92-0.98)	0.93** (0.90-0.96)	0.99 (0.96-1.02)
Hours worked per week	0.99* (0.98-1.00)	0.96** (0.95-0.98)	0.99* (0.98-1.00)	0.97** (0.96-0.99)	0.99 (0.98-1.01)	0.99 (0.97-1.00)	0.99 (0.97-1.01)
Self-employed	1.48* (1.10-2.01)	1.40 (0.75-2.59)	1.60** (1.18-2.18)	1.33 (0.85-2.09)	1.59 (1.05-2.39)	1.54* (1.04-2.27)	1.38 (0.85-2.24)
Education	0.88** (0.84-0.93)	0.98 (0.88-1.08)	0.88** (0.84-0.93)	0.88** (0.82-0.95)	0.88** (0.82-0.95)	0.87** (0.80-0.94)	0.89** (0.82-0.95)
Non-white	0.84 (0.66-1.07)	0.75 (0.46-1.24)	0.79* (0.62-1.00)	0.83 (0.57-1.21)	0.84 (0.62-1.14)	N/A N/A	N/A N/A
Manufacturing	0.83 (0.64-1.07)	0.59 (0.32-1.07)	0.99 (0.77-1.27)	0.64* (0.44-0.93)	1.00 (0.71-1.42)	0.72 (0.50-1.03)	0.99 (0.70-1.42)
Male	0.70** (0.52-0.87)	0.70 (0.41-1.18)	0.78 (0.60-1.01)	N/A N/A	N/A N/A	0.71 (0.49-1.03)	0.65* (0.46-0.93)
Family income	1.00 (1.00-1.00)	N/A N/A	N/A N/A	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)
Exercise (2002)	0.45** (0.36-0.57)	0.46** (0.27-0.77)	0.52** (0.41-0.66)	0.32** (0.22-0.47)	0.57** (0.43-0.77)	0.37** (0.26-0.52)	0.57** (0.41-0.79)
Diet (2002)	1.38** (1.09-1.74)	1.47 (0.91-2.37)	1.37** (1.08-1.73)	1.32* (0.90-1.92)	1.41* (1.04-1.90)	1.51* (1.08-2.12)	1.21 (0.88-1.67)
Smoker (1998)	1.82** (1.423-2.32)	2.25** (1.29-3.92)	1.49** (1.18-1.90)	1.54** (1.06-2.24)	2.00** (1.45-2.76)	2.01** (1.42-2.86)	1.53* (1.09-2.16)
N (observations)	22,050	9,315	16,442	11,139	10,911	12,249	9,801
N (individuals)	6,069	3,277	5,135	2,942	3,127	3,190	2,879

Odds ratios reported, 95% CI in parentheses; model controls for survey year and census division (results not reported); ** <0.01, * <0.05

¹Low-wage calculated based on the definition of the U.S. Department of Health and Human Services as 150% of the federal poverty level.

Table 3: Cumulative Effect of Piece Rate on the Odds of Worker Health Limitations

Variable	Full model	Not Low-wage ¹	Low-wage	Male	Female	White	Non-white
Piece rate	1.43 (0.99-2.06)	0.66 (0.28-1.57)	1.43* (1.01-2.03)	1.06 (0.60-1.86)	1.96** (1.20-3.18)	0.87 (0.49-1.53)	2.16** (1.34-3.47)
Health Insurance	0.79 (0.62-1.02)	0.48 (0.23-1.03)	1.00 (0.79-1.26)	0.72 (0.48-1.06)	0.87 (0.62-1.22)	0.75 (0.51-1.09)	0.86 (0.61-1.20)
Age	1.07** (1.02-1.13)	1.08 (0.97-1.20)	1.09** (1.03-1.14)	1.13** (1.04-1.23)	1.03 (0.96-1.10)	1.11** (1.03-1.19)	1.05 (0.97-1.13)
Tenure at primary job	0.96** (0.93-0.98)	0.99 (0.95-1.04)	0.95** (0.93-0.98)	0.97 (0.93-1.00)	0.95** (.92-0.98)	0.93** (0.90-0.96)	0.99 (0.96-1.02)
Hours worked per week	0.99** (0.97-1.00)	0.97** (0.95-0.98)	0.99* (0.978-1.00)	0.97** (0.96-0.98)	0.99 (0.98-1.01)	0.98** (0.97-1.00)	0.99 (0.97-1.01)
Self-employed	1.35 (0.96-1.90)	1.15 (0.55-2.39)	1.52* (1.08-2.13)	1.21 (0.72-2.04)	1.44 (0.91-2.26)	1.51 (0.97-2.35)	1.12 (0.65-1.96)
Education	0.88** (0.84-0.93)	0.99 (0.89-1.10)	0.89** (0.85-0.95)	0.89** (0.82-0.96)	0.88** (0.82-0.95)	0.88** (0.81-0.95)	0.88** (0.82-0.96)
Non-white	0.80 (0.63-1.03)	0.75 (0.45-1.26)	0.77* (0.60-0.97)	0.78 (0.53-1.16)	0.81 (0.59-1.11)	N/A N/A	N/A N/A
Manufacturing job	0.86 (0.66-1.12)	0.71 (0.39-1.29)	0.97 (0.75-1.26)	0.67 (0.45-0.99)	0.97 (0.68-1.39)	0.79 (0.54-1.15)	0.97 (0.67-1.40)
Male	0.70** (0.51-0.88)	0.67 (0.39-1.16)	0.78 (0.60-1.01)	N/A N/A	N/A N/A	0.74 (0.50-1.09)	0.62* (0.43-0.91)
Family income	1.00 (1.00-1.00)	N/A N/A	N/A N/A	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)
Exercise (2002)	0.46** (0.36-0.58)	0.39** (0.23-0.68)	0.56** (0.44-0.71)	0.31** (0.20-0.46)	0.61** (0.45-0.82)	0.37** (0.26-0.52)	0.59** (0.42-0.83)
Diet (2002)	1.41** (1.10-1.79)	1.40 (0.86-2.30)	1.38** (1.08-1.75)	1.38 (0.93-2.05)	1.42* (1.05-1.93)	1.56* (1.10-2.20)	1.23 (0.88-1.71)
Smoker (1998)	1.79** (1.39-2.31)	2.31** (1.30-4.08)	1.49** (1.17-1.90)	1.60* (1.08-2.39)	1.90** (1.37-2.65)	2.18** (1.51-3.13)	1.38 (0.96-1.98)
N (observations)	20,171	8,256	15,385	10,068	10,103	11,064	9,107
N (individuals)	6,016	3,098	5,064	2,919	3,097	3,165	2,851

Odds ratios reported, 95% CI in parentheses; model controls for survey year and census division (results not reported); ** <0.01, * <0.05
¹Low-wage calculated based on the definition of the U.S. Department of Health and Human Services as 150% of the federal poverty level.

Table 4: Summary Statistics for Cross-Sectional Health Data Sample

Variable	Definition	Categories	Worker ever paid Piece Rate		Worker ever paid based on Performance (Piece rate, bonuses, tips, stock options, commissions, other)	
			Yes	No	Yes	No
Health limitation	Worker has health limitations	0=No, 1=Yes	0.14** n=929	0.08 n=2,528	0.10 n=4,736	0.09 n=1,253
General health	General Perception of Health	1=Excellent, ...,5= Poor	2.46** n=926	2.27 n=2,524	2.30 n=4,728	2.32 n=1,250
Health limits work	Health limits work activity	0=No, 1=Yes	0.12** n=928	0.08 n=2,524	0.10 n=4,725	0.08 n=1,250
Health limits social	Health limits social activity	1=Always, ..., 6=Never	5.49** n=926	5.64 n=2,521	5.57 n=4,722	5.63 n=1,248
Asthma	Worker has asthma	0=No, 1=Yes	0.08* n=924	0.06 n=2,522	0.08** n=4,718	0.05 n=1,248
Back problems	Worker has back problems	0=No, 1=Yes	0.25* n=926	0.22 n=2,522	0.24 n=4,719	0.23 n=1,248
Feet and leg problems	Worker has feet and leg problems	0=No, 1=Yes	0.22** n=926	0.16 n=2,522	0.19 n=4,721	0.17 n=1,248
Kidney or bladder problems	Worker has kidney/bladder problems	0=No, 1=Yes	0.06* n=926	0.04 n=2,522	0.04 n=4,719	0.04 n=1,248
High cholesterol	Worker has high cholesterol	0=No, 1=Yes	0.12** n=915	0.09 n=2,484	0.12** n=4,664	0.08 n=1,227
Depression or anxiety	Worker has depression/anxiety	0=No, 1=Yes	0.14** n=926	0.11 n=2,521	0.13 n=4,717	0.11 n=1,248
Bursitis	Worker has bursitis	0=No, 1=Yes	0.16** n=926	0.12 n=2,521	0.15* n=4,719	0.12 n=1,248
Severe tooth or gum trouble	Worker has severe tooth/gum problems	0=No, 1=Yes	0.08** n=926	0.05 n=2,521	0.06 n=4,720	0.05 n=1,248
Loss of finger or toe	Worker has finger or toe loss	0=No, 1=Yes	0.03* n=153	0.01 n=974	0.01 n=687	0.01 n=510
Frequent trouble sleeping	Worker has frequent trouble sleeping	0=No, 1=Yes	0.18** n=925	0.13 n=2,521	0.16** n=4,717	0.13 n=1,248
Hardening of arteries	Worker has hardened arteries	0=No, 1=Yes	0.01** n=924	0.00 n=2,513	0.00 n=4,711	0.00 n=1,243

T-tests on continuous outcomes or chi-square tests on binary outcomes presented as p-value (** <0.01, * <0.05)

Available health outcomes in 40th birthday panel not statistically significant: Duration of health limitation, work injury or illness, emotionality and emotional health problems, stomach ulcers, heart trouble, low blood pressure, frequent colds or allergies, frequent indigestion, paralysis, trick shoulder, hepatitis or tuberculosis, headaches or fainting, eye trouble, ear/nose/throat trouble, skin diseases, thyroid trouble, allergic to medicine, tumors, bone deformity, neuritis, epilepsy, frequent urinary infections, osteoporosis, ulcer, anemia

Appendix

NLSY1997 Data Limitations

NLSY1997 cohort results were not presented along with the primary results from NLSY1979 due to data limitations and sample size concerns with the second cohort. Although there were responses across all years in the 1997 cohort to questions related to performance and piece rate pay as well as an additional dependent variable ‘gig pay,’ there were much fewer responses per year than existed in the 1979 dataset. In other words, while the key dependent variables in the analyses are asked in all years (1997, 1998, 1999, ..., 2015), there were very few responses compared to the NLSY79 data set, which has the question asked in fewer years (1988, 1989, 1990, and 1996, 1998, 2000) but many more responses when the question is present.

For example, in NLSY1997, in the few counties where someone responds "yes" there are never more than one response per county. This contrasts to NLSY79 data where there are often counts of over 50 in large urban counties. In the entire NLSY97 sample, the number of workers reporting piece rate ranged from only 10-60 individuals annually in the entire cohort. The sample size of workers reporting ‘gig pay’ was slightly larger (36 – 198) and larger still for performance pay, a category that encompasses all forms of performance-related pay (278-1,315). The minimum number of workers paid performance pay in a given year across NLSY79 was measurably greater (1,741-2,137). So while sample size limitations were already a legitimate concern in the 1979 dataset, the issue became untenable for the 1997 cohort analysis. We do not believe that this is indicative of a lack of workers in the cohort being paid by performance measures, only a lack of reporting these measures through the survey mechanism. Regardless, the sample size and availability of self-reported measures of performance and piece rate pay were not sufficient to test these hypotheses for the later cohort.

The conclusion we reached is that the NLSY97 data is not appropriate for the performance pay type analysis, although it does have many responses for other questions and may be useful for exploring hypotheses unrelated to pay type. We did not anticipate this issue in advance simply because the public dataset descriptions reported that performance and piece rate data were available for all years, while there was no mention of annual sample size limitations.