

Final Progress Report

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Table of Contents:

| | |
|---------------------------------------|---|
| Abstract | 3 |
| Highlights/Significant findings | 3 |
| Translation of findings | 3 |
| Scientific Report | 4 |
| Publications | 8 |
| Inclusion of Gender/Minority Subjects | 9 |
| Inclusion of Children | 9 |

Abstract:

The primary aims of this work were to investigate longitudinal associations between occupation and alcohol use disorders (AUD) across early-to-mid adult life. Longitudinal trajectories of work substantive complexity were constructed by growth mixture modeling (GMM) of occupational data from the National Longitudinal Survey of Youth 1979 and O*NET work variables, modeling men and women separately. Association between work trajectories and AUD was modeled using generalized linear models and adjusting for education. Both men and women exhibit a 3-class work trajectory model. Lower work trajectories were associated with higher AUD prevalence and incidence. Incident AUDs were associated with a subsequent decline in work trajectory class for both high and low initial classes; more strongly in women despite lower overall AUD incidence.

We conclude that low work trajectory is associated with increased AUD prevalence.

Development of an AUD may presage risk of decline in work SC. These findings suggest reinforcing relations between the development of AUD and occupational course at mid-life.

Highlights & Significant Findings:

1. Risk for alcohol use disorder (AUD) varies as a function of occupational trajectory, with low-trajectory (less-privileged) subjects at greater risk throughout early and mid-adulthood
2. Equivalent findings for risk of AUD are seen in men and women, although the prevalence of AUD in men was twice that in women
3. Alcohol use disorder was associated with a decline in subsequent career trajectory in both men and women. The effect of AUD work was stronger for women, while men demonstrated a stronger association with past education and the risk of AUD
4. No significant pattern of AUD risk was seen according to race/ethnicity, although black subjects in general had a lower AUD risk overall. Within-trajectory difference in AUD by race were not significant by race, although blacks were more represented in lower-trajectory classes

Translation of Findings:

Overall by mid-adulthood, there is increased risk for a decline in ones occupational trajectory associated with development of an AUD. Evidence for a declining trajectory in an AUD-positive subject can be observed as soon as two years following the assessment of alcohol use and abuse, and these declines intensify over the remaining period. As we did not observe an incipient decline in work SC prior to the second assessment and assignment of AUD status in 1994, this suggests that declining occupational trajectory is a consequence of AUD development, rather than a predictor.

Some notable differences are seen between men and women in the survey: educational attainment at each stage of the survey appears to be a stronger predictor than work trajectory in men, whereas work was more strongly associated with AUD in women. As overall 1994 incidence of AUD in women (4.9%) was less than half that of men (11.9%), an incident AUD in women appears to lead to a sharper decline in occupational trajectory, even in the more privileged. Possible reasons for this are not readily apparent, and bear further investigation; however it may suggest career paths in women that are more readily disrupted by alcohol-related disorders than might occur in men. Alternative suggestions are higher levels of work-family conflict associated with drinking in women, particularly in more demanding jobs, and differential gender composition of jobs which leads to greater drinking through social interactions or increased job stressors (46). Additional detail on both personal and structural facets of participants' workplaces would be required to test these possible explanations.

These findings suggest the interrelation between the development of AUD and both prior and subsequent work characteristics, and indicate that studies of the association between alcohol-related disorders and occupation may be complex and self-reinforcing. These findings may provide a basis for future studies that examine the consequences of alcohol misuse and other work-related health outcomes.

Scientific Report:

During the study period the following tasks were undertaken:

- 1) Downloading, cleaning and examination of data from the National Longitudinal Survey of Youth (NLSY79) from years 1979 to 2000 on occupation, alcohol habits and intake, alcohol use and abuse, education, and other relevant covariates.
- 2) Classification of respondents as heavy drinkers or as having alcohol use disorder (AUD), defined using the 25-item instrument in the 1989 and 1994 NLSY79 to classify subjects according to DSM-IV criteria for AUDs
- 3) Factor analysis of the O*NET version13 to derive metrics for the principal occupational factors of interest (substantive complexity and physical demands of work)
- 4) Creation of a crosswalk between the 1980 Census and the O*NET to enable imputation of occupational characteristics to employment histories in the NLSY79
- 5) Examination of the convergent and predictive validity of the O*NET-derived factor metrics for occupational exposure, contrasting those with self-reported characteristics
- 6) Preliminary examination of drinking patterns and AUDs by broad occupational classification/industrial sector, and by educational attainment
- 7) Construction of temporal trajectories of occupational characteristics using growth mixture modeling (GMM)
- 8) Assessment of risk for alcohol use disorders at two points in the survey (1989 and 1994) by longitudinal trajectory class using generalized linear models and binomial regression
- 9) Re-construction of longitudinal class trajectories of work at and after 1994, to determine the risk of change in trajectory class (eg downward vs stable) after development of AUD

The following represent findings from preliminary analyses:

1989: Alcohol Dependence was found in 11.6% of current drinkers (n=766).

- More males than females reported being current and heavy drinkers. There were also significantly more males than females who reported alcohol dependence ($p < 0.0001$).

1994: Similar to 1989, alcohol dependence was reported in 11.6% of current drinkers.

- Males were more likely than females to be current, or heavy drinkers, and also to have alcohol dependence ($p < 0.0001$). Overall, alcohol use decreased between 1989 and 1994.

Validity of O*NET Measures: Variance-partitioning models for O*NET factors were contrasted with self-rated job control scores from the JCQ in the MIDUS I survey. The intra-class correlation coefficient for the unconditional model was 25.6%, indicating that one-quarter of the overall variance in self-rated job control was attributable to differences between occupations, with the remainder ascribable to within-occupation (between-subject) variability. When a 5-item O*NET control score was added to the model as a fixed effect the ICC was reduced by greater than 75%, indicating, once between-subject variability is partitioned, considerable congruence between job control scores derived from the O*NET and self-rated scores from the survey. By contrast, the degree of shared variance between the O*NET substantive complexity factor score and survey job control was considerably lower: the ICC was reduced by slightly over one-third (37.7%).

Regression analyses of survey- and O*NET derived factors with self-rated health showed modest associations of all three factors with self-rated health (OR's 1.05 -1.10). All work-

characteristic factors were robust to possible confounders entered in the models; associations with O*NET-derived factors were mildly attenuated when adjusted for household income. Longitudinal analyses for self-rated health and new-onset hypertension across the ten-year period between the two surveys were also performed. All three job-characteristics measures emerged as modest predictors of a decline in self-rated health between the two surveys, with borderline statistical significance after adjustment. Substantive complexity, however, emerged as a much stronger predictor of new hypertension in employed subjects between 1995 and 2005. (adjusted OR 1.57 vs 1.24 for self-rated control. Overall, the O*NET factors validity was demonstrated, as occupational characteristics derived from O*NET variables performed as well or better than survey-based job control in describing associations with self-rated health and incident hypertension.

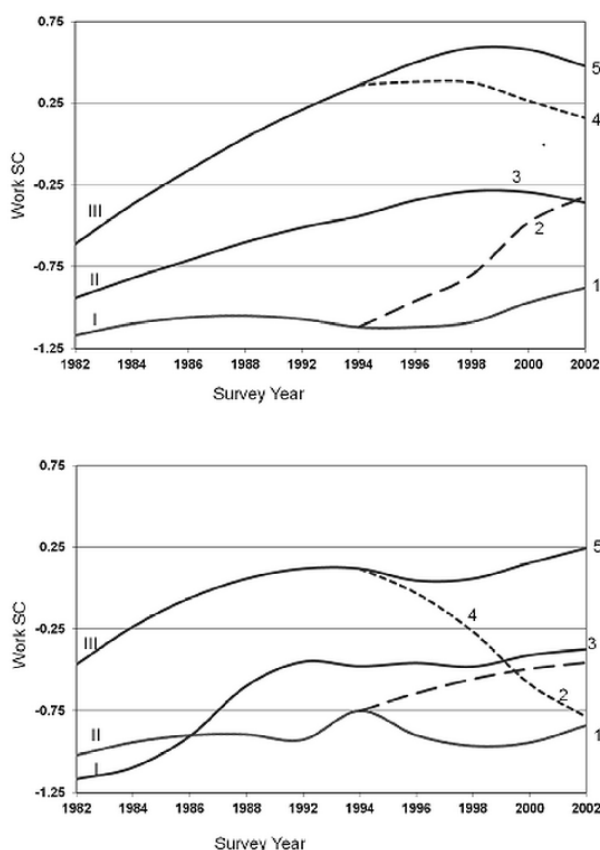
Alcohol dependence by broad occupation: The top 4 employment categories reported were a) managerial and professional specialties, b) administrative support/clerical; c) service; d) precision production, craft repair.

In 1989, the managerial and professional specialties employment category accounted for 21.3% of alcohol dependant participants, vs. 33.6% precision production/ craft/ repair workers. Six percent of managerial/ professional workers were alcohol dependant, in comparison to 8.1% administrative, 11.8% service, and 18.0% precision production/craft/repair ($p=0.000$). A similar pattern is evident in 1994, where managerial (6.3%) and administrative (6.2) workers report less incidence of alcohol dependence in comparison to service (11.8) and precision production/craft/repair (20.4%) workers. This difference was statistically significant ($p=0.000$). Examination of work substantive complexity scores across the years of the survey yields results in the expected direction, demonstrating different initial status and trajectories by race/ethnicity (Figure) and by educational attainment (not shown).

Construction of GMM Trajectories of Work: Multivariate analyses using a latent growth trajectory framework were undertaken. General growth mixture modeling (GGMM) was used to construct longitudinal trajectories of work characteristics, accounting for educational attainment and background characteristics in men and women separately. These models allow estimation of risk and growth trajectories based upon longitudinal repeated-measures across time. Preliminary inspection of these models indicates: 1) clear evidence of differential trajectories, with a 3 class solution being most representative; 2) clear evidence of differential self-rated health between trajectories; and 3) evidence of considerable racial/ethnic differences in composition of trajectory classes, with Black subjects in lower-trajectory classes despite equivalent education.

Construction of occupational histories and imputation of work SC scores across the period from 1982 – 2002 yielded 5915 men (92.5% of male NLSY79 participants) and 5734 women (91.3%) with at least two data points, considered sufficient for trajectory construction. Information on educational attainment for 1994 (within one year before or after 1994) was available for 10,317 (88.6%) of those 11,649 subjects.

Growth mixture modeling of work SC from 1980-1994 yielded three-class solutions as the best-fitting initial model for both men and women subjects. Entropy and aBIC results were equivalent to those previously obtained, and demonstrated no additional improvement beyond a three-class solution. For both men and women, recalculation of intra-class trajectories subsequent to 1994 resulted in the splitting of Classes I and III each into two separate post-1994 trajectories, with a one-class trajectory for Class II continuing (**Figure 1**, right side of graphs). These post-1994 models yield the occupational trajectories shown on the right side of Figure 1 (Arabic numerals 1-5), and can be described as a stable versus a falling trajectory for Class III, and, for Class I, a stable/flat trajectory for the majority of subjects, contrasted with a rising trajectory in a smaller number of participants. The low-intercept, flat-trajectory class (I) comprises nearly one-half (45.6%) of the male subjects and over two-thirds (68.9%) of women, a second class (Class



II) has a moderate positive slope, and a third class (III, 25.7% men, 21.5% women) shows a higher intercept and a sharper upward trajectory. Black subjects were overrepresented in the flat-trajectory Class I (which contained 60% and 75% of male and female Black subjects respectively), and underrepresented in Class III. Male Hispanic subjects were distributed evenly within the three classes, whereas Hispanic women were found mainly in Class I. Educational attainment was unequally distributed by class; college-educated subjects were found primarily in Class III, while Class I comprised the majority of participants without a high school degree. Mean income for subjects in Class III was over twice that those in Class I.

The prevalence of alcohol use disorders (AUDs) in 1989 survey participants was 15% in men and 7.3% in women overall, and decreased with increasing trajectory class for both sexes (p-value by chi-squared test <0.001). A similar gradient

by trajectory class was seen in incident AUD cases at the time of the 1994 survey (p<0.001).

Among occupations with 20 or more subjects responding to the 1994 NLSY survey, the highest proportion of men meeting criteria for an incident AUD were: plumbers and pipefitters (38% meeting AUD criteria), bartenders (36%), groundskeepers and gardeners (29%), carpenters (28%), and welders and cutters (28%). In women, high AUD incidence was noted in bartenders (44%), receptionists (11.1%), waiters and waitresses (11%) and assemblers (9.5%). Occupations with no incident AUD cases in men in 1994 included elementary teachers (out of 54 subjects), investigators and adjusters (48 subjects), computer programmers (35), police and detectives (30), and social workers (27). A similar lack of incident AUD cases in women were noted in elementary teachers (47 subjects), investigators and adjusters (36), and social workers (22).

Prevalence ratios in 1989 and incidence ratios for the period 1989-94 for alcohol use disorders by trajectory class are shown in **Table I**, along with estimation of AUD risk by race/ethnicity, and education. The gradient across main trajectory classes that was seen in the raw data of Table 1 persists on adjustment for these factors, with a significant p-value for the trend across classes. Education was a stronger predictor of AUD in men than occupational trajectory; the opposite was noted in women, although the risk estimate may also reflect a low absolute risk for AUD in the highest work trajectory. Black participants exhibited a decreased risk for AUD, consistent with other studies.

The association of incident AUD in 1994 and subsequent occupational trajectory was further examined. The odds for AUD in post-1994 trajectory classes were contrasted using Class 5, the sub-class within Class III that exhibited a continued steady increase in work SC after 1994, as a referent. A flat or downward trajectory was associated with an incident AUD in the post-1994 occupational trajectories; this was particularly striking for women originally in Class III

| | 1989 | | 1994 | |
|-------------------------|-------------|---------------|-------------|----------------|
| | Adjusted PR | 95% CI | Adjusted OR | 95% CI |
| MEN | | | | |
| Trajectory Class | | | | |
| III (highest) | REF | | REF | |
| II | 1.03 | (0.77 – 1.38) | 1.19 | (0.80 - 1.76) |
| I | 1.42 | (1.07 – 1.88) | 1.49 | (1.02 - 2.19) |
| Race/Ethnicity | | | | |
| White | REF | | REF | |
| Black | 0.77 | (0.60 – 0.98) | 1.05 | (0.76 - 1.47) |
| Hispanic | 0.88 | (0.68 – 1.14) | 1.14 | (0.85 - 1.52) |
| Education | | | | |
| >16 years | 1 | | | |
| 13-15 years | 2.03 | (1.33 - 3.08) | 2.40 | (1.31 - 4.38) |
| 12 years | 2.42 | (1.73 - 3.39) | 3.11 | (1.89 - 5.12) |
| <12 years | 3.03 | (1.98 - 4.61) | 6.16 | (3.53 - 10.74) |
| WOMEN | | | | |
| Trajectory Class | | | | |
| III (highest) | REF | | REF | |
| II | 2.05 | (1.28 – 3.29) | 2.04 | (0.79 - 5.23) |
| I | 2.32 | (1.31 – 4.11) | 3.13 | (1.49 - 6.56) |
| Race/Ethnicity | | | | |
| White | REF | | REF | |
| Black | 0.61 | (0.41 – 0.91) | 0.82 | (0.50 - 1.32) |
| Hispanic | 0.78 | (0.51 – 1.19) | 0.76 | (0.43 - 1.36) |
| Education | | | | |
| >16 years | 1 | | | |
| 13-15 years | 1.54 | (0.88 - 2.71) | 1.09 | (0.51 - 2.35) |
| 12 years | 1.76 | (1.10 - 2.81) | 1.06 | (0.56 – 2.03) |
| <12 years | 3.43 | (1.87 - 6.31) | 3.11 | (1.48 - 6.53) |

where the downsloping trajectory was associated with an eight-fold risk of AUD. For men in the subset of Class I participants who demonstrated a clear increase in work SC trajectory after 1994 risk was closest to that of the high-trajectory (Class III-5) referent group (OR = 1.39 with a non-significant confidence interval) and distinctly at lower risk than the Class I subjects with a

stable or flat work trajectory. This was not seen, however in women, although an AUD in Class I in women was also more strongly associated with flat or declining trajectory. Strong associations of educational attainment with AUD in men were again seen, while much more attenuated in women, with greater risk only in those lacking a high-school diploma or equivalent.

| Initial Trajectory Class | Trajectory Class after 1994 | Direction (contrast with initial trajectory) | MEN | | WOMEN | |
|--------------------------|-----------------------------|--|---------------------|---------------|---------------------|---------------|
| | | | Adjusted Odds Ratio | 95% CI | Adjusted Odds Ratio | 95% CI |
| III (highest) | 5 | Upward/ Stable | REF | - | REF | - |
| | 4 | Downward | 3.88 | (1.97 – 7.61) | 8.06 | (1.96 – 33.2) |
| II | 3 | Upward/ Stable | 2.30 | (1.48 – 3.58) | 5.03 | (1.34 – 18.9) |
| I | 2 | Upward | 1.67 | (0.90 - 3.01) | 6.34 | (1.89 - 21.2) |
| | 1 | Flat | 2.21 | (1.39 - 3.51) | 9.32 | (2.69 - 32.2) |
| Race/Ethnicity | | | | | | |
| White | | | REF | | REF | |
| Black | | | 1.10 | (0.83 - 1.45) | 0.83 | (0.51 - 1.35) |
| Hispanic | | | 1.05 | (0.76 - 1.44) | 0.78 | (0.43 - 1.42) |
| Education | | | | | | |
| >16 years | | | REF | | REF | |
| 13-15 years | | | 1.72 | (1.06 - 2.81) | 0.85 | (0.42 - 1.72) |
| 12 years | | | 2.44 | (1.57 - 3.79) | 0.95 | (0.49 – 1.81) |
| <12 years | | | 4.46 | (2.73 - 7.29) | 2.53 | (1.21 - 5.28) |

In light of strong educational gradients associated with incident 1994 AUDs, at least in men, we considered the possibility that differences in progressive educational attainment across the time preceding the 1994 assessment may be confounding the association between occupational trajectory and risk for AUD. This could occur, for example, if the onset of an alcohol use disorder was associated with reduced motivation to advance in education or career. To examine this possibility, ANCOVA analyses of individual change in educational attainment between 1989 and 1994, by trajectory and incident AUD were performed, controlling for prior (1989) educational level. Educational attainment did not differ within occupational trajectories for AUD-positive versus AUD-negative subjects, whereas there were significant differences in educational advancement within pre-1994 trajectories between those with higher and lower post-1994 trajectories. Notably, AUD-positive women in Class III had higher mean educational advancement during this period, although not statistically significant ($p=0.21$ for the mean differences between the two groups in post-1994 classes 4 and 5). Overall, changes in educational attainment appeared to be drivers of trajectory class (as seen in the differential mean educational-level changes between post-1994 classes), but were not associated with alcohol use disorder.

Publications to date:

Meyer JD , Mutambudzi M. Association of occupational trajectories with alcohol use disorders in a longitudinal national survey. *J Occup Environ Med* (accepted, in press)

Meyer JD, Cifuentes M, Warren N. Association of self-rated physical health and incident hypertension with O*NET factors: Validation using a representative national survey. *J Occup Environ Med* 2011; 53:139-145

Meyer JD, Mutambudzi M. Construction of trajectories of work complexity and their association with subsequent health. EPICOH 2011: 22nd International Conference on Epidemiology in Occupational Health, Sept 7-9 2011. Oxford, UK.

Meyer JD, Mutambudzi M. Association of occupational trajectories with alcohol use disorders in a longitudinal national survey EPICOH 2014: Chicago IL (accepted – oral presentation)

Discoveries and Inventions under this award: None, with none planned.

Inclusion of Gender and Minority Subjects:

The NLSY includes 12,000 subjects, split equally among men and women. Minorities were deliberately oversampled, and thus the overall composition of the survey participants was 25% Black/African-American and 16% Hispanic/Latino

Inclusion of Children:

Subjects were from 14-21 years when first interviewed in 1979; all subjects were therefore represented as both children and adults

Tables & Figures**Figure 1:**