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Perceived stress levels and the risk of developing T2D
- a register-based cohort study

BACKGROUND: Perceived stress has been associated with type 2 diabetes (T2D) in previous studies. However, current research is not clear and a validated psychometric scale to assess the degree of perceived stress has not previously been used. This study aimed to examine the association between perceived stress and onset of T2D in temporal sequence with validated psychometric scale.

METHODS: This retrospective cohort study comprised of 29,873 participants (50,72% male) age ranged from 16 to 95 who had answered the questionnaire: Danish Health Profile in 2010 or 2013 in North Denmark Region. The questionnaire holds information on lifestyle factor and perceived stress measured by 10-item Cohen's perceived stress scale. Diabetics were identified through three registers and contained the following types of data; prescription drugs, discharge diagnosis, and blood test registers. Data from the Danish Health Profile, the registers used to identify diabetics, and registers for other risk factors were cross-linked by means of unique personal identification numbers. Cox regression model was used to estimate the risk of developing diabetes in relation to the different stress levels.

RESULTS: In total, 503 participants had developed DM II during the 3.7-year study period. The cumulative incidence proportion increased gradually from 1.5% in the low-stress group and to a maximum of 4.4% in the high-stress group during the 3.7-year study period. After full model adjustment moderate stress and high stress had HR's of 1.36 (CI 1.13 to 1.64) and 2.08 (CI 1.21 to 3.57) when compared to the low-stress group.

CONCLUSION: This large-scale register-based cohort study found a positively correlated association between the development of type two diabetes and a high degree of perceived stress after adjustment for participants baseline characteristics.

KEYWORDS: Cohen's perceived stress scale, diabetes, cohort, PSS-10, psychological stress.

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Introduction:

Global prevalence of diabetes rose dramatically from 108 million people in 1980 to 422 million in 2014(1). The number of people living with T2D in Denmark was 227,700 people and is estimated to be 429,300 in 2030 despite already implemented preventive measures against well-known modifiable risk factors(2). The number of undiagnosed diabetics in Denmark has been estimated to 60,000 people(3). T2D have considerable implications for an individual and puts a large socio-economic burden on our society(4). Cost of Diabetics in Denmark was estimated to 14,349 euro per person-year in 2011(4). Diabetes is associated with numerous health complications including nephropathy(5), renal failure(5), retinopathy, neuropathy(6), cerebro-cardiovascular diseases(7) and depression(8). Diabetes and its complications have been shown to reduce quality of life in individuals(9). Several of well-known risk factors exists for developing DM II including abnormal BMI(10)(11), age(12), gender, low socioeconomic status(13), insufficient or excess sleep, physical inactivity and smoking. The mechanism of action in T2D works by increased insulin resistance in body tissues along with dysfunction insulin secreting pancreatic β-cells. At some point insulin resistance surpass the pancreatic β-cells capacity for insulin production which results in progression to T2D.

The terminology of stress are broad as stress has various aspects and covers several domains. Selye used the term word “stress” to represent anything that seriously threatens homeostasis(14). An object, a person or situations that are perceived as threatening and/or negatively is referred to as a stressor. Response, to a stressor is called a stress response and has been part of evolutionary adaptive actions. Stress can negatively affect an individual’s health, social life, relationship and work(15). Stress can measured in various ways including measure of stressful life events, degree of perceived stress, and serum-cortisol. A person who perceives an object, a person or situations as threatening and/or negatively responds rapidly with activation of the sympathetic nervous system coupled in addition to upregulation of the hypothalamic-pituitary-adrenal (HPA) axis which sequentially results in the release of cortisol, a glucocorticoid from the adrenal cortex. However, chronic activation is the problem affecting health rather than an acute stress response which is part of normal physiology. Cortisol release, in response to stress promotes the mobilization of energy stores, which then induce the release of glucose and lipids into the circulation This causes dysregulated cortisol level with excessive cortisol production which affects the glucose homeostasis to a higher level. Cortisol bind to glucocorticoid receptors also expressed in pancreatic β-cells. Cortisol stimulation directly decrease insulin sensitivity and when the cortisol binds to receptors in pancreatic β-cells insulin secretion is reduced. Chronic activation of the HPA axis is considered a key part in the mechanism of action by which stressed individuals develop diabetes. A stress response to a external stressor such as a heavy workload will vary greatly in the way it manifests itself from individual to the next; as the degree to which one perceived a stressor is also determined also by genes and internal factors: including perception, personality, and learned patterns of coping(15).

Bjorntorp first proposed in 1991 that neuroendocrine responses to stressors might increase accumulation of abdominal fat(16). Several years later, Bjorntorp and Rosmond et al. demonstrated another model which suggests that HPA axis and the sympathetic nervous system when exposed to chronic stress are gradually reprogrammed and responsible for insulin resistance, central obesity and hypertension(17–19). Siddiqui used multiple ways

to measure stress and found newly diagnosed DM II to have both higher degree of stress and salivary cortisol than did people with normal glucose tolerance(20). In a large cohort study With findings in a cohort study with women and with temporally repeated measures of stress, Harris et al. proposed a causal model with mediators explaining 10-20% of the excess variation in diabetes(21). Although previous studies found an association between stress and D2M, most of these studies had their methodological limitations(22,23). Kato et al. used a one-item psychometric tool to measure stress(24). Additionally, Harris et al and other studies have relied primarily on self-reports to identify diabetics(21,24,25). To our knowledge, no large-scale study which adjusts for covariates and includes both genders has investigated the association between perceived stress and DM II with a well-validated psychometric tool to assess degree of perceived stress.

Thus, this large scale cohort study seek to investigate an association with temporal sequence between degree of perceived stress and risk of developing DM II over 3.7 years period, with a widely validated psychometric tool to measure perceived stress.

Method:

Study design

This register-based cohort study was based on data from Statistics Denmark, who manage a range of numerous registers. Data was gathered from the questionnaires Danish Health Profile 2010, and 2013. The questionnaires included general health questions and the 10-item Cohen's Perceived Stress Scale (PSS-10) to assess degrees of perceived stress. Data regarding diabetics was gathered through three registers containing blood samples, hospital discharge diagnoses, and prescription medicine. Death dates, household income and educational status was likewise register-based.

with both genders Kato et al. found a significant association in men between stress and risk of developing DM II.

Each Health Profiles composed of a study population of 35,700 people, age 16 and above and was stratified across the 11 municipalities in the North Denmark Region(26,27).Health Profile 2010, and 2013 both sent out a questionnaire to participants and later two reminders in proximity to deadline to ensure a high response rate.

Distinctively, the Health Profile 2010, a targeted group of 6,807 people with the lowest response rate in the working age inclusive of men under the age of 50 and women in the age 18 to 36 were contacted by telephone prior to deadline to increase response rate. Data was collected from 5th of February until 22th of March 2010 for Health Profile 2010. Health Profile 2013 collected data from 30th January to 1th of May 2013. Baseline was set to the last response date, respectively. 23,392 (65.5%) participants responded to Health Profile 2010, and 20,220 participants responded (56.5%) to Health Profile 2013. 1,720 participants received the questionnaire in both 2010 and 2013. Generally, response rate 5-10 % were lower among men and in participants between the age of 16-34.

Exposure

The 10-item Danish version of PSS was used(28). PSS-10 is a widely used psychometric tool to assess degree of perceived stress(29,30) It is a scale to which a subjective perception of stress in various degrees over the past month can be deduced quantifiably. Question items relate to which extent respondents found their lives unpredictable, uncontrollable and overloading. Four of the ten items tap into how well the respondents cope with stress. Each item is rated from; never, almost never, sometime, fairly often, very often and is categorized from 0-4. Item 4, 5, 7 and 8 regarding coping are positive

connoted and are for this reason reversed in score in order to correspond with the negative connoted stress items. For comparison participants were grouped into three degrees of perceived stress by their collective PSS score; low (0-13), moderate (14-26), high (27-40), as a higher score indicates higher perceived stress.

Outcome:

Three registers were used to recognize diabetes; Danish National Patient Register(31), the Danish National Prescription Register(32), and Clinical laboratory information system (LABKA)(33) which contains data from diagnostic test. Data from the three registers was cross-linked by encrypted CPR numbers, using the danish civil registration register. Data was collected from these registers and from them; hospital discharge diagnoses, prescription drugs, and diagnostic tests were used to identify diabetic and differentiate between D2M and other types of diabetes. This was also used for exclusion, and right-censoring. It is possible that a small number of diabetics were not identified in any of the registers. These participants would still be identified and excluded if they reported to be a diabetic on a item in the Health Profile questionnaires. In order to identify diabetics diagnostic tests were evaluated with following cut-off' for diabetes; HbA1c being above or equal to 48 mmol/mol (≥ 6.5 %), fasting plasma blood glucose (FPG)above or equal to 7.0 mmol/mol, plasma blood glucose above or equal to 11.1 mmol/mol measured 120 minutes after an oral glucose loading (OGTT). Additionally, data was collected from Danish National Patient Register which contains hospital discharge diagnoses based on WHO's International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10). Diabetic diagnoses were used to identify diabetes and specific type of diabetes. The Danish prescription Register include dispensing dates for drugs and is registered using the Anatomical Therapeutic Chemical ATC classification system. Data was collected and ATC-codes relevant to diabetes were used. To be identified as type 2 diabetic by purchases of prescription drugs required two purchases of standalone oral antidiabetic drug or in combination with insulin, identified by NPU codes. To be identified as type 2 diabetic by hospital discharge diagnosis required either; one specific type diagnosis or two unspecified diagnosis. If participants were identified to have other types of diabetes by the use of ATC-codes and diagnoses relevant to type one diabetes and other types of diabetes were used to exclude/or right-censor participants.

Participants having PCOS was identified through either the specific ICD-10 diagnosis or by a combination of prescription drugs(34). Participants who were identified to have had PCOS prior to baseline were excluded and right-censored if identified during the study. Participants with PCOS were excluded if identification dates were prior to baseline and censored if identified after baseline.

People identified as diabetics from more than one register had more than one identification date for diabetes, in these cases the earliest date were chosen Data was collected from the Danish register of Causes of Death to identify deaths(35). Participants who died before baseline were excluded and who died after were right-censored The proportion of people with no or one general practitioner's consolations in the year prior to baseline was calculated to investigate if this was evenly distributed.

Covariates

Age was identified in the Health Profile and included as a categorical variable. Age was categorized into six groups; 16-29, 30-39, 40-49, 50-59, 60-69, and ≥70 years of age.

Gender was identified in the Health Profile.

Body mass index (BMI) was calculated based on height and weight reported in the Health Profile. BMI was grouped into the following six;

underweight (<18,5), normal weight (BMI=18.5–24.9), pre-obesity(BMI=>25.0–29.9), obesity class I (BMI >30.0–34.9), obesity class II (BMI>35.0-39,9), obesity class III (BMI>40)(36).

Sleep was identified in the Health Profile and included as a categorical variable. Sleep was categorized into three groups; insufficient sleep, sufficient sleep, and excessive sleep. Questions regarding sleep differed in the questionnaires; in the questionnaire from 2010 daily hours of sleep was reported whereas the number of days per week with < 5 hours and > 9 hours of sleep in the past four weeks was estimated in the questionnaire from 2013(37). Participants from Health Profile 2010 were grouped accordingly based on; < 7, 7-9 and ≥ 10 hours of daily sleep. Participants from Health Profile 2013 were divided into three groups by; ≥3 days with a maximum and ≤1 with minimum 9 hours of sleep, a sufficient amount of sleep and ≥ 3 days with a minimum of 9 hours of sleep with ≤1 day with a maximum of five hours per week.

Physical activity was assessed by the self-reported level of work- and exercise-activity in the Health Profile and included as a dichotomous variable. Participants in the Health Profile were asked to estimate their physical activity as well exercise activity reflecting a year back. Participants were categorized into to groups; physically active, and physically inactive(38). Participants whose work-activity that for the majority of time included walking/lifting/heavy straining work and/or 4 > hours of exercise- or heavy household-activity with moderate/high intensity were recognized as physically active.

Alcohol consumption was identified in the Health Profile and included as a categorical variable. Alcohol intake was based on weekly consumption of beers, glasses of wine, hard liquor reported in units. One unit in Denmark is equivalent to 12 grams of alcohol. Moderate intake has been shown to reduce the risk of developing diabetes(39). Participants were categorized into three groups; no consumption, moderate consumption and consumption exceeding 40 g/day of alcohol for men and 20 g/day for women(39).

Smoking habits were assessed by smoking status and tobacco consumption in the Health Profile and included as a categorical variable. In the Health Profile participants were asked to report smoking status; never smoked, former smoker, smoking sometimes or daily smoker and daily tobacco consumption of cigarettes, cheroots, cigars or pipe bowls of tobacco. Cheroots, cigars and pipe bowls of tobacco were converted into the equivalent number of cigarettes. Smoking habits were categorized into four groups; never smoked, former smoker, smoker and heavy smoker equivalent to ≥20 cigarettes/day(40).

Socioeconomic status was assessed by both household income and educational status(41).

Data about household income was collected from the Danish Income Statistics Register(42). A yearly average household income was calculated based on three consecutive years prior to baseline. Health Profile 2010 and 2013 were categorized separately into groups by quartiles references for household income based on the total population of the North Denmark Region.

Data about educational status was collected the Danish Education Register(43). Educational Status was categorized into three groups; Primary education (Basic school), Secondary education (High school or vocational education of 2-4 years), Higher education (≥ 2 years of higher education).

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Data management

A χ2−test was used to examine baseline characteristics for categorical variables, with a 0.05 level of significance. The cox regression analysis was used in order to estimate the association between perceived stress and the development of DM II. The moderate- and high-stress groups was estimated with the low-stress group as a reference. All assumptions of the cox regression model were satisfied. Schoenfeld analysis was performed to verify the assumption of proportional hazard. Schonfeld did not differ significantly from 0 and is included in appendix 3. An unadjusted cox analysis was performed, as well as a adjusted. Covariants selected prior to the analysis include age, gender, smoking, alcohol consumption, BMI, household-income, sleep-duration, educational-level, and physical activity level. Covariates were analysed for interaction. No interaction was found, included in appendix 2. R was used to plot a cumulative incidence graph for the three groups of perceptive stress. The full analysis exclude a large percent of the study population due to missing covariant. Imputation on missing covariates except alcohol was done as a sensitivity analysis. A cox adjusted analysis was performed on the imputed dataset and was congruent with the full analysis, results can be found in Appendix 1. A sub-group was performed separately of gender, as prior studies suggest different hazard ratios of gender. The follow up period was 3.7 years, this was set, as the registers of diagnosis codes reached this far. SAS version 9.4 TS Level 1M2 was used as the primary software to handle data processing.

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Results:

Health Profile 2010, and 2013 had a total of 43,612 respondents. 1,982 respondents from 2013 was removed as they had previously received a questionnaire in 2010. The final study population composed of 29873 and were followed for 3,7 years during which 503 incident DM II were identified. Missing data was highest of alcohol intake (12%) and activity level (3.4%), and smaller of smoking (1,1%) and sleep (1,3%). At baseline, high levels of perceived stress were more common among, smokers, women, underweight people and overweight people (BMI >35), people under 67 years of age, people with low educational level and people in the lower income groups as well as people that drank above the recommended dose. People sleeping more or less was also abundant in the high-stress group. X2 was performed to examine baseline characteristics of participants grouped into stress levels was all found to be significant (p=<0.0001).

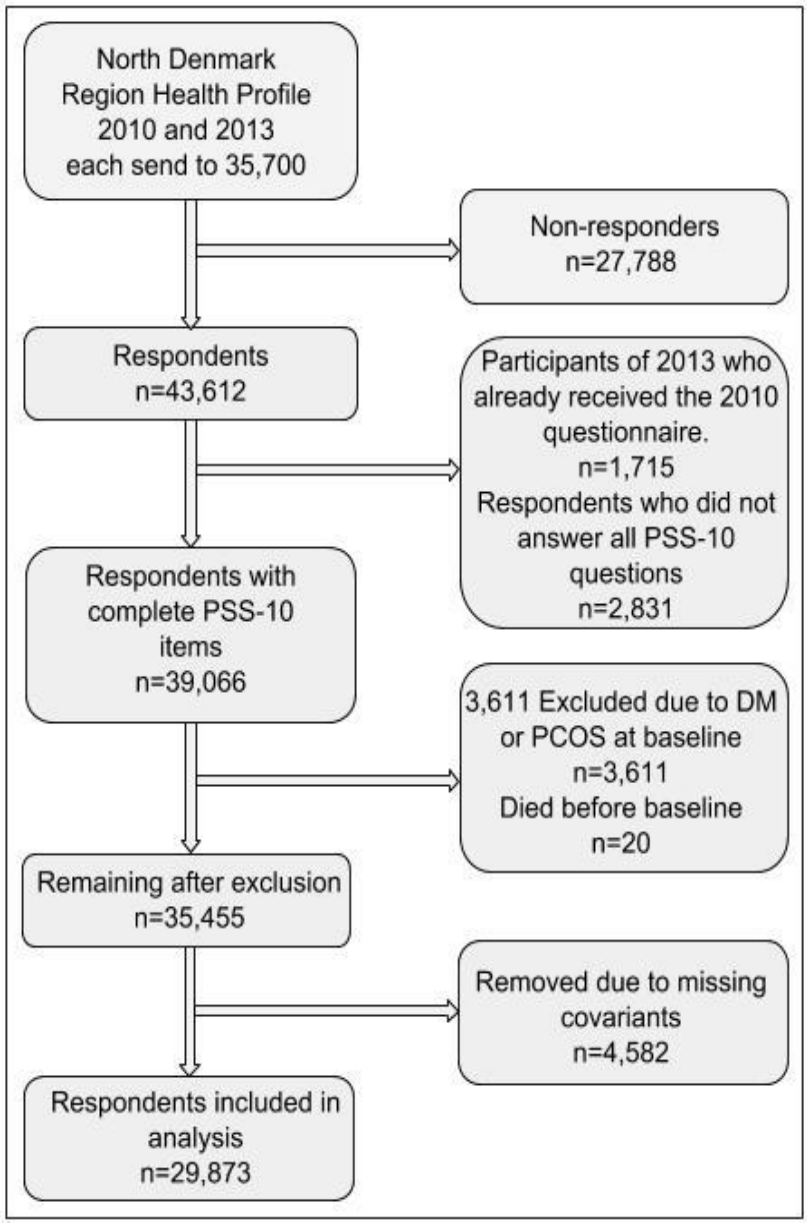

Figure 1 Flow diagram shows the selection of the final study population. 35,700 were selected for participation in each of the Danish Health Profile 2010 and 2013. 27,788 were removed due to non-respondents, 1,715 who received questionnaires in 2010 as well as 2013, 2,831 with incomplete PSS-10, 3,611 to exclusions, 20 who died before baseline, and 4,582 were removed due to missing covariates. The final study population concluded a total of 29,873 participants

Table 1: Baseline characteristics for participants in Health Profile 2010, and 2013 with non-diabetics and those who developed type 2 diabetics over a 3.7-year period. **n(%)**

Variable	Level	Non-diabetics (n=29370)	type II diabetics (n=503)	total (n=29,873)	P-value
PSS-10 Group	Low	19709 (98.59)	281 (1.41)	19990 (66.92)	
	Moderate	9211 (97.80)	207 (2.20)	9418 (31.53)	
	High	450 (96.77)	15 (3.23)	465 (1.56)	<0.0001
Age	16-29	4887 (99.73)	13 (0.27)	4900 (16.40)	
	>29-39	3795 (99.45)	21 (0.55)	3816 (12.77)	
	>39-49	5954 (99.02)	59 (0.98)	6013 (20.13)	
	>49-59	6155 (98.15)	116 (1.85)	6271 (20.99)	
	>59-69	5574 (97.11)	166(2.89)	5740 (19.21)	
	>69	3005 (95.91)	128(4.09)	3133 (10.49)	<0.0001
Gender	Female	14505 (98.53)	216 (1.47)	14721 (49.28	
	Male	14865 (98.11)	287 (1.89)	15152 (50.72)	<0.0001
BMI	>18.5	1112 (98.76)	14 (1.24)	1126 (3.77)	
	18.5-24.9	13590 (99.35)	89 (0.65)	13679 (45.79)	
	25.0-29.9	10691 (98.10)	207 (1.90)	10898 (36.48)	
	30.0-34.9	3116 (96.41)	116 (3.59)	3232 (10.82)	
	35.0-39.9	667 (93.03)	50 (6.97)	717 (2.40)	
	>40	194 (87.78)	27 (12.22)	221 (0.74)	<0.0001
Physical activity	Active	12411 (99.06)	118 (0.94)	12529 (41.94)	
	Inactive	16959 (97.78)	385 (2.22)	17344 (58.06)	<0.0001
Sleep	Inadequet	3529 (97.86)	77 (2.14)	3606 (12.07)	
	Sufficient	24833 (98.46)	389 (1.54)	25222 (84.43)	
	Excess	1008 (96.46)	37 (3.54)	1045 (3.50)	<0.0001
Alcohol consumption	None	13499 (98.47)	210 (1.53)	13709 (45.89)	
	Under 40/20 grams of alcohol per day	14976 (98.17)	279 (1.83)	15255 (51.07)	
	Above 40/20 grams of alcohol per day	895 (98.46)	14 (1.54)	909 (3.04)	<0.0001
Smoking	Non-smoker	14469 (98.80)	176 (1.20)	14645 (49.02)	
	Ex-smoker	8534 (97.76)	204 (2.33)	8738 (29.25)	
	Smoker <20 cigarettes/day	4397 (98.59)	63 (1.41)	4460 (14.93)	
	smoker ≥20	1970 (97.04)	60 (2.96)	2030 (6.80)	<0.0001
Income quartiles	1 - Lowest	4279 (98.96)	45 (1.04)	4324 (14.47)	
	2	5696 (97.25)	161 (2.75)	5857 (19.61)	
	3	8618 (98.01)	175 (1.99)	8793 (29.43)	
	4 - Highest	10777 (98.88)	122 (1.12)	10899 (36.48)	<0.0001
Education	Primary	8385 (97.78)	190 (2.22)	8575 (28.70)	
	Secondary	13443 (98.48)	208 (1.52)	13651 (45.70)	
	Higher	7542 (98.63)	105 (1.37)	7647 (25.60)	<0.0001

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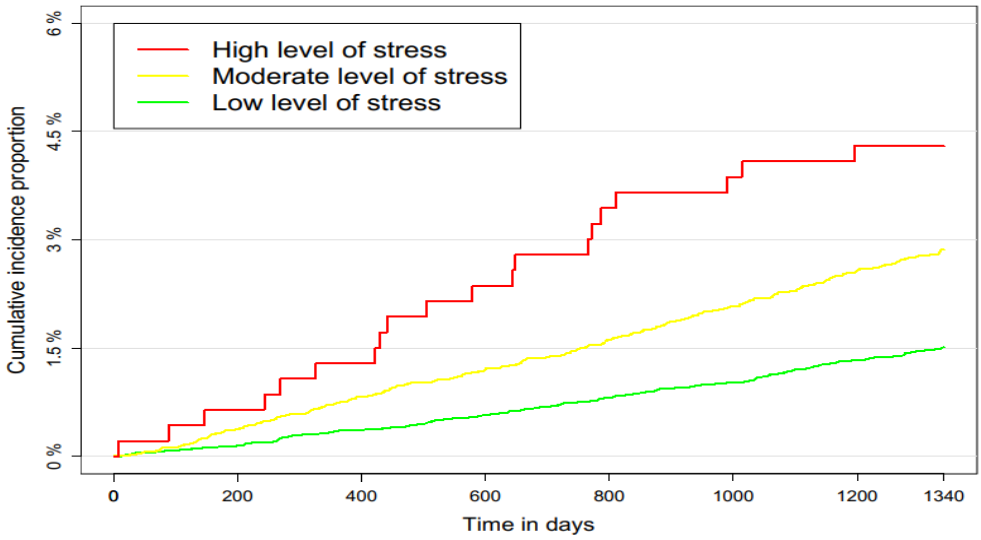

Figure 2 Cumulative incidence proportion of DM 2 incident according to degree of perceived stress determined by Cohen's Perceived stress scale (PSS-10) in Health Profile 2010, and 2013, and over a 3.7 years period. n=29,429

Table 2: - Unadjusted and adjusted estimated hazard ratios for the risk of developing DM II over a 3.7-year study period comparing the moderate- and high-stress group with the low-stress group as a reference with perceived stress measured by Cohen's Perceived Stress Scale prior to baseline (N=29,873). *Unadjusted - Cox analysis. (N=35,455). **Full Adjusted Cox, adjusted for age, gender, BMI, physical inactivity, educational level, household income, alcohol consumption, and smoking Model 2. *** Gender analysis for men and women, respectively - cox analyses adjusted for age, BMI, physical inactivity, educational level, household income, alcohol consumption, and smoking.

Table 2 Hazard ratios of different models of adjustment

	Unadjusted cox		Full Adjusted cox		Men only		Women only	
PSS-10 GROUP	HR	95% CI	HR	95% CI	HR	95% Ci	HR	95% CI
Low	1	reference	1	reference	1	reference	1	reference
Moderate	1.58	1.51 to 2.03	1.36	1.13 to 1.64	1.25	0.97 to 1.60	1.53	1.16 to 2.02
High	2.38	1.41 to 3.99	2.08	1.21 to 3.57	2.16	0.98 to 4.77	1.87	0.87 to 3.99

Cumulative incidence proportion of diabetes is shown in figure 2. The high-stress group had the cumulative incidence proportion of 5.4% after 3.7 years, whereas the low-stress group had the lowest incidence of 1.9%.

The results of Cox proportional hazard regression are shown in figure 3, inclusive of a model without covariates and a full model including covariates with low stress group as a reference. In the unadjusted model moderate- and high-stress groups both had statistically significant higher risk of developing T2D with HRs of 1.58 (CI 95% 1.51:2.03) and 2.38 (CI 95% 1.41:3.99), respectively. In the adjusted model HRs were slightly attenuated but remained statistical significant. The covariant adjusted model displays for the moderate- and high- stress groups HR's of 1.36 (CI 95% 1.13;1.64) and 2.08 (CI 95% 1.21;3.57), accordingly. On the account of the covariant adjusted model, the moderate stress group has a 1.36-fold greater risk of developing D2M in contrast to the reference group. Preeminently, the high stress group had a 2.02-fold increased risk of developing D2M than the reference group.

Supplementary analysis

To examine the relationship of gender separately, a covariant adjusted model were examined for women (n=14721) and men (n=15152) independently. For women the moderate- and high stress groups present HRs of 1.53 (CI 95% 1.16;2.02) and 1.87 (CI 95% 0.87;3.99), each. The moderate group remained statistically significant, while the high stress group did not. Antagonistically, the moderate- and high stress groups for men were estimated HRs of 1.25 (CI 95% 0.97;1.60) and 2.16 (CI 95% 0.98;4.77) with only the high stress group remaining statistically significant. Imputation on missing data for physical activity, sleep and smoking-status increased the study population by 4.3% to a total of 31168. The full model with imputed data estimated just slightly higher HR in the high stress group and is included in appendix 1.

Discussion

The main aim of this study was to investigate the association between relative degrees of perceived stress at baseline and the risk of developing T2D during the 3.7-year study period when adjusting for potential covariates.

The findings of this study after using the full model adjustment demonstrates that moderate- and high- degree of perceptive stress at baseline when compared to low-stress were associated with increased HR's of 1.36 (CI 95% 1.13;1.64) and 2.08 (CI 95% 1.21;3.57), respectively. The group with a high level of perceived stress had 2.1-fold greater risk of developing DM II during a 3,7 year period. When analyzed by gender separately, women in the moderate-stress group remained significant.

In a case-control study Siddiqui et al matched 125 newly diagnosed DM II with 125 controls with normal glucose tolerance and showed linkage between perceived stress, newly diagnosed DM II(20). Additionally, Siddique also found 10 pm salivary cortisol to be significantly higher in newly diagnosed diabetic than healthy controls and thereby associating chronic stress with DM II. However, Siddique was unable to determine whether perceived stress was a cause or consequence of DM II due case-control study design. Similar studies have found a linkage between stress and diabetes(22). In a large cohort study Kato et al. found a temporally sequenced as well as graded association between everyday stress and DM II (24). Similarly, Rod et al. found a significant association for men but not women in a longitudinal study(25). Overall findings of this study are in accordance with the aforementioned studies. Kato et al. used one-item to measure degree of perceived stress while Rod et al. used two-items to measure degree and frequency of stress. In contrast, our study used the PSS 10-item to measure degree of perceived stress. PSS taps into the degree of unpredictability, uncontrollability, overloading as

measure of stress as well as coping resources. We considered it questionable that these one- two-items instruments also be capable of this and to same extent. Few-items instruments might be useful in large population and some studies has supported their validity. However, they have yet to be used or validated to the same extent and in as many culturally different populations as PSS has been. Contraily, Harris et al. asked women to rate their degree of stress in ten life domains over the past 12 months and women with moderate/high stress levels were significantly associated with increased risk of DM II 3 three years later. Kato et al. and Rod et al. both assessed levels of perceived stress by a single question/item directly related to stress(24,25).

Strength and limitations

The main strengths of our study include the use of a validated psychometric tool to assess degree of perceived stress, identification of diabetics by three distinct registers, and our large-scale population-based cohort. Access to national surveys and registers of high quality supported the use of detailed baseline characteristics on socioeconomic status and well-known modifiable risk factors for DM II as well as multiple ways of identifying diabetics through hospital-discharges, prescription drugs and blood samples. All participants regardless of socioeconomic status had access to free (tax-funded) health care.

When comparing incidence of DM II in respondents and non-respondents from the 2010 survey, an incidence of 4,24% was observed for responders while non-responders was 4,13%, during the 3.7-year observation period. High levels of stress could be a reason for not responding. It is considered unlikely that the effect of stress in non-responders on developing diabetes differed from the responders.

The identification of diabetes was strengthened through the use of registers, including blood samples, hospital discharges, and medicine. There is the possibility that a group of diabetics are undetected if they do not have any blood samples, hospital discharges or no use of anti-diabetic drugs. This is speculated to be a small inconsequential number of people, since most diabetics receive medicinal treatment. A substantial proportion of people with T2D is undiagnosed as mentioned earlier If undiagnosed diabetics are included in the study and are later diagnosed during the study time, they would be included as false positives. If healthy participants included in the study develop diabetes during the study, but are not diagnosed until after the study ends, they would be included as false negatives. This would not affect the relative risk if these false positives and false negatives are distributed group wise in proportion to the respective incidence for the group. There was no required preliminary screening for T2D at baseline nor at the end of the study, which gives rise to the possibility of misclassification bias, as a diagnosis of DM requires medical investigation. The proportion of people in the stress-groups with no or only a single general practitioner's consultation in the year prior to baseline was 35%, 25% 15% for the low-, moderate- and high-stress groups respectively. The highest proportion of people with no or one GP consultation was found in the low-stress group whereas the high-stress group had the lowest proportion. We considered it conceivable that the proportion of people with no or only a single GP consultation prior to baseline might be inversely related with the percentage of undiagnosed diabetics getting diagnose in the year prior to baseline. On that account, the low-stress group would contain the highest proportion of undiagnosed diabetics included from baseline and followed by the moderate-stress group. The low-stress group will have a greater ratio of false positives to true positives if the fraction of undiagnosed diabetics getting diagnosed during the study does not differ among the groups. This would cause the relative risk to move towards null, underestimating the relative risk. With the assumption that the

dissimilarity in the proportion of people with no or only a single GP consultation continues to exist throughout the study time one might hypothesize that this could disproportionately increase the likelihood of measuring the specified outcome during the observation period in the most stressed group. In addition, the low-stress group might be disposed to a greater number of false negatives compared with the high-stress group.

The 10-item PSS measures the degree of perceived stress within the past month. It has been validated numerous times in previous studies with a Cronbach's alpha >0.70(30); likewise Cronbach's alpha was estimated to 0.86 in this large population-based cohort. Cronbach's alpha deal in part with the inter-relatedness of items within a test. The PSS-10 measures everyday stress which makes it relatively free of content that is specific to any particular population(29) as opposed to some other ways of measuring stress such as perceived work-related stress. One limitation of this study was that perceived stress was only measured once at baseline. We estimated it to be unlikely that it would contribute to differential misclassification bias instead non-differential misclassification was considered more probable which would create bias toward the null.

Conclusion

In this large-scale retrospective cohort study, higher degrees of perceived stress compared to low degree of stress was shown to be significantly associated with increased risk of developing T2D in a 3.7 years period, when adjusting for typical risk factors compared to those with low degree of perceived stress. The prevalence of D2M continues to grow along with the large socioeconomic burden despite already implemented preventive measures taken to reduce of T2D. The findings of this study indicate that higher degrees of perceived stress is strongly associated with increased risk of developing T2D. This study's findings encourage that perceived stress be integrated in preventive measure to reduce risk of T2D.

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Appendix 1

Cox regression full model of men and women

Model Fit Statistics

Criterion	Without Covariates	With Covariates
-2 LOG L	10346.803	9696.628
AIC	10346.803	9748.628
SBC	10346.803	9858.363

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	650.1748	26	<.0001
Score	797.8057	26	<.0001
Wald	602.8124	26	<.0001

Type 3 Tests

Effect	DF	Wald Chi-Square	Pr > ChiSq
cpss_grp	2	14.8913	0.0006
C_KON	1	1.5039	0.2201
alder_grp	5	143.8791	<.0001
bmi_grp	5	292.9864	<.0001
motion_grp	1	6.7333	0.0095
sovn_grp	2	8.0465	0.0179
alcohol_grp	2	3.7382	0.1543
ryger_grp	3	18.3955	0.0004
indkomst_grp	3	6.4485	0.0917
uddgr	2	1.3018	0.5216

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
cpss_grp	**1**	1	0.31048	0.09469	10.7501	0.0010	1.364	1.133	1.642	cpss_grp 1
cpss_grp	**2**	1	0.73092	0.27671	6.9773	0.0083	2.077	1.208	3.572	cpss_grp 2
C_KON	**K**	1	-0.12217	0.09962	1.5039	0.2201	0.885	0.728	1.076	Køn K

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
alder_grp	**1**	1	0.66693	0.37061	3.2383	0.0719	1.948	0.942	4.028	alder_grp 1
alder_grp	**2**	1	1.21308	0.32898	13.5965	0.0002	3.364	1.765	6.410	alder_grp 2
alder_grp	**3**	1	1.89047	0.31681	35.6077	<.0001	6.623	3.559	12.322	alder_grp 3
alder_grp	**4**	1	2.24051	0.31037	52.1102	<.0001	9.398	5.115	17.268	alder_grp 4
alder_grp	**5**	1	2.58138	0.30857	69.9831	<.0001	13.215	7.218	24.195	alder_grp 5
bmi_grp	**0**	1	0.54155	0.28909	3.5091	0.0610	1.719	0.975	3.029	bmi_grp 0
bmi_grp	**2**	1	0.88850	0.12875	47.6220	<.0001	2.431	1.889	3.129	bmi_grp 2
bmi_grp	**3**	1	1.55823	0.14330	118.2428	<.0001	4.750	3.587	6.291	bmi_grp 3
bmi_grp	**4**	1	2.32092	0.18082	164.7539	<.0001	10.185	7.146	14.517	bmi_grp 4
bmi_grp	**5**	1	2.96179	0.22392	174.9463	<.0001	19.333	12.465	29.984	bmi_grp 5
motion_grp	**1**	1	0.28885	0.11132	6.7333	0.0095	1.335	1.073	1.660	motion_grp 1
sovn_grp	**0**	1	0.18442	0.12707	2.1062	0.1467	1.203	0.937	1.543	sovn_grp 0
sovn_grp	**2**	1	0.46062	0.17587	6.8593	0.0088	1.585	1.123	2.237	sovn_grp 2
alcohol_grp	**1**	1	0.07478	0.09687	0.5960	0.4401	1.078	0.891	1.303	alcohol_grp 1
alcohol_grp	**2**	1	-0.44352	0.28832	2.3664	0.1240	0.642	0.365	1.129	alcohol_grp 2
ryger_grp	**1**	1	0.15772	0.10564	2.2290	0.1354	1.171	0.952	1.440	ryger_grp 1
ryger_grp	**2**	1	0.19503	0.14826	1.7303	0.1884	1.215	0.909	1.625	ryger_grp 2
ryger_grp	**3**	1	0.66973	0.15633	18.3526	<.0001	1.954	1.438	2.654	ryger_grp 3
indkomst_grp	**1**	1	0.47281	0.20279	5.4361	0.0197	1.605	1.078	2.388	indkomst_grp 1
indkomst_grp	**2**	1	0.27931	0.14365	3.7804	0.0519	1.322	0.998	1.752	indkomst_grp 2
indkomst_grp	**3**	1	0.22860	0.12429	3.3826	0.0659	1.257	0.985	1.604	indkomst_grp 3
uddgr	**1**	1	0.01160	0.13215	0.0077	0.9301	1.012	0.781	1.311	uddgr 1
uddgr	**2**	1	-0.09784	0.12360	0.6266	0.4286	0.907	0.712	1.155	uddgr 2

Cox regression full model of imputed data

Model Fit Statistics

Criterion	Without Covariates	With Covariates
-2 LOG L	11235.215	10531.462
AIC	11235.215	10583.462
SBC	11235.215	10695.235

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	703.7526	26	<.0001
Score	860.1143	26	<.0001
Wald	648.9514	26	<.0001

Type 3 Tests

Effect	DF	Wald Chi-Square	Pr > ChiSq
cpss_grp	2	19.9550	<.0001
C_KON	1	2.8004	0.0942
alder_grp	5	148.7461	<.0001
bmi_grp	5	315.5523	<.0001
motion_grp	1	9.3454	0.0022
sovn_grp	2	7.2743	0.0263
alcohol_grp	2	3.1417	0.2079
ryger_grp	3	16.8634	0.0008
indkomst_grp	3	9.8245	0.0201
uddgr	2	1.3964	0.4975

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
cpss_grp	**2**	1	0.32158	0.09100	12.4870	0.0004	1.379	1.154	1.649	cpss_grp 2
cpss_grp	**3**	1	0.86579	0.25404	11.6151	0.0007	2.377	1.445	3.911	cpss_grp 3
C_KON	**1**	1	0.16033	0.09581	2.8004	0.0942	1.174	0.973	1.416	C_KON 1

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
alder_grp	**0**	1	-0.71934	0.36820	3.8169	0.0507	0.487	0.237	1.002	alder_grp 0
alder_grp	**2**	1	0.64989	0.25201	6.6505	0.0099	1.915	1.169	3.139	alder_grp 2
alder_grp	**3**	1	1.29755	0.23760	29.8240	<.0001	3.660	2.298	5.831	alder_grp 3
alder_grp	**4**	1	1.62203	0.23612	47.1912	<.0001	5.063	3.188	8.043	alder_grp 4
alder_grp	**5**	1	1.91007	0.24739	59.6110	<.0001	6.754	4.159	10.968	alder_grp 5
bmi_grp	**2**	1	0.43453	0.27876	2.4299	0.1190	1.544	0.894	2.667	bmi_grp 2
bmi_grp	**3**	1	0.85591	0.12272	48.6459	<.0001	2.354	1.850	2.993	bmi_grp 3
bmi_grp	**4**	1	1.48485	0.13780	116.1016	<.0001	4.414	3.369	5.783	bmi_grp 4
bmi_grp	**5**	1	2.34078	0.17048	188.5220	<.0001	10.389	7.438	14.511	bmi_grp 5
bmi_grp	**6**	1	2.88490	0.21494	180.1548	<.0001	17.902	11.747	27.280	bmi_grp 6
motion_grp	**2**	1	-0.33084	0.10822	9.3454	0.0022	0.718	0.581	0.888	motion_grp 2
sovn_grp	**2**	1	0.12156	0.12428	0.9566	0.3280	1.129	0.885	1.441	sovn_grp 2
sovn_grp	**3**	1	0.43945	0.16729	6.9004	0.0086	1.552	1.118	2.154	sovn_grp 3
alcohol_grp	**2**	1	0.06358	0.09331	0.4643	0.4956	1.066	0.888	1.279	alcohol_grp 2
alcohol_grp	**3**	1	-0.38382	0.27031	2.0162	0.1556	0.681	0.401	1.157	alcohol_grp 3
ryger_grp	**2**	1	0.17096	0.10172	2.8247	0.0928	1.186	0.972	1.448	ryger_grp 2
ryger_grp	**3**	1	0.23051	0.14083	2.6790	0.1017	1.259	0.956	1.660	ryger_grp 3
ryger_grp	**4**	1	0.61689	0.15147	16.5861	<.0001	1.853	1.377	2.494	ryger_grp 4
indkomst_grp	**1**	1	0.56553	0.18945	8.9111	0.0028	1.760	1.214	2.552	indkomst_grp 1
indkomst_grp	**2**	1	0.32699	0.13910	5.5263	0.0187	1.387	1.056	1.821	indkomst_grp 2
indkomst_grp	**3**	1	0.25592	0.12139	4.4446	0.0350	1.292	1.018	1.639	indkomst_grp 3
uddgr	**1**	1	0.12416	0.11971	1.0757	0.2997	1.132	0.895	1.432	uddgr 1
uddgr	**2**	1	0.08941	0.10101	0.7835	0.3761	1.094	0.897	1.333	uddgr 2

Cox regression full model of men

Model Fit Statistics

Criterion	Without Covariates	With Covariates
AIC	5513.357	5204.577
SBC	5513.357	5296.064

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	358.7803	25	<.0001
Score	427.0152	25	<.0001
Wald	301.5043	25	<.0001

Type 3 Tests

Effect	DF	Wald Chi-Square	Pr > ChiSq
cpss_grp	2	5.6200	0.0602
C_KON	0	.	.
alder_grp	5	74.7704	<.0001
bmi_grp	5	136.0900	<.0001
motion_grp	1	2.5227	0.1122
sovn_grp	2	5.7242	0.0571
alcohol_grp	2	2.7489	0.2530
ryger_grp	3	6.8950	0.0753
indkomst_grp	3	0.8874	0.8285
uddgr	2	3.1073	0.2115

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
cpss_grp	**1**	1	0.21913	0.12837	2.9141	0.0878	1.245	0.968	1.601	cpss_grp 1
cpss_grp	**2**	1	0.77145	0.40347	3.6559	0.0559	2.163	0.981	4.769	cpss_grp 2
alder_grp	**1**	1	0.80683	0.70922	1.2942	0.2553	2.241	0.558	8.997	alder_grp 1
alder_grp	**2**	1	1.93169	0.62685	9.4961	0.0021	6.901	2.020	23.577	alder_grp 2

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
alder_grp	**3**	1	2.52828	0.61686	16.7988	<.0001	12.532	3.741	41.984	alder_grp 3
alder_grp	**4**	1	2.94959	0.61124	23.2860	<.0001	19.098	5.764	63.282	alder_grp 4
alder_grp	**5**	1	3.15870	0.61190	26.6471	<.0001	23.540	7.095	78.101	alder_grp 5
bmi_grp	**0**	1	0.46447	0.52498	0.7827	0.3763	1.591	0.569	4.452	bmi_grp 0
bmi_grp	**2**	1	0.76829	0.17666	18.9146	<.0001	2.156	1.525	3.048	bmi_grp 2
bmi_grp	**3**	1	1.37269	0.19870	47.7261	<.0001	3.946	2.673	5.825	bmi_grp 3
bmi_grp	**4**	1	2.11273	0.25780	67.1610	<.0001	8.271	4.990	13.708	bmi_grp 4
bmi_grp	**5**	1	2.91399	0.30695	90.1220	<.0001	18.430	10.098	33.636	bmi_grp 5
motion_grp	**1**	1	0.22012	0.13859	2.5227	0.1122	1.246	0.950	1.635	motion_grp 1
sovn_grp	**0**	1	0.30465	0.16771	3.2999	0.0693	1.356	0.976	1.884	sovn_grp 0
sovn_grp	**2**	1	0.42381	0.23509	3.2500	0.0714	1.528	0.964	2.422	sovn_grp 2
alcohol_grp	**1**	1	0.01570	0.13185	0.0142	0.9052	1.016	0.784	1.315	alcohol_grp 1
alcohol_grp	**2**	1	-0.51993	0.33576	2.3979	0.1215	0.595	0.308	1.148	alcohol_grp 2
ryger_grp	**1**	1	0.18101	0.14103	1.6474	0.1993	1.198	0.909	1.580	ryger_grp 1
ryger_grp	**2**	1	-0.07174	0.22739	0.0995	0.7524	0.931	0.596	1.453	ryger_grp 2
ryger_grp	**3**	1	0.46583	0.19836	5.5152	0.0189	1.593	1.080	2.350	ryger_grp 3
indkomst_grp	**1**	1	-0.02729	0.31482	0.0075	0.9309	0.973	0.525	1.804	indkomst_grp 1
indkomst_grp	**2**	1	0.12418	0.18553	0.4480	0.5033	1.132	0.787	1.629	indkomst_grp 2
indkomst_grp	**3**	1	0.12172	0.15565	0.6116	0.4342	1.129	0.832	1.532	indkomst_grp 3
uddgr	**1**	1	0.28824	0.18455	2.4394	0.1183	1.334	0.929	1.915	uddgr 1
uddgr	**2**	1	0.09527	0.17283	0.3038	0.5815	1.100	0.784	1.543	uddgr 2

Cox regression full model of women

Model Fit Statistics

Criterion	Without Covariates	With Covariates
AIC	4137.939	3869.111
SBC	4137.939	3953.493

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	318.8281	25	<.0001
Score	406.9195	25	<.0001
Wald	311.5295	25	<.0001

Type 3 Tests

Effect	DF	Wald Chi-Square	Pr > ChiSq
cpss_grp	2	9.7262	0.0077
C_KON	0	.	.
alder_grp	5	66.7001	<.0001
bmi_grp	5	156.3783	<.0001
motion_grp	1	4.9949	0.0254
sovn_grp	2	3.7709	0.1518
alcohol_grp	2	0.6109	0.7368
ryger_grp	3	19.6046	0.0002
indkomst_grp	3	11.6459	0.0087
uddgr	2	3.9218	0.1407

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
cpss_grp	**1**	1	0.42394	0.14271	8.8250	0.0030	1.528	1.155	2.021	cpss_grp 1
cpss_grp	**2**	1	0.62420	0.38714	2.5996	0.1069	1.867	0.874	3.987	cpss_grp 2
alder_grp	**1**	1	0.73781	0.44754	2.7179	0.0992	2.091	0.870	5.028	alder_grp 1
alder_grp	**2**	1	0.76239	0.41361	3.3977	0.0653	2.143	0.953	4.821	alder_grp 2

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
alder_grp	**3**	1	1.55997	0.38843	16.1286	<.0001	4.759	2.223	10.189	alder_grp 3
alder_grp	**4**	1	1.81600	0.37728	23.1686	<.0001	6.147	2.935	12.877	alder_grp 4
alder_grp	**5**	1	2.34067	0.36724	40.6231	<.0001	10.388	5.058	21.337	alder_grp 5
bmi_grp	**0**	1	0.56332	0.35065	2.5809	0.1082	1.756	0.883	3.492	bmi_grp 0
bmi_grp	**2**	1	0.95619	0.18947	25.4691	<.0001	2.602	1.795	3.772	bmi_grp 2
bmi_grp	**3**	1	1.71080	0.20707	68.2615	<.0001	5.533	3.688	8.303	bmi_grp 3
bmi_grp	**4**	1	2.52061	0.25435	98.2077	<.0001	12.436	7.554	20.473	bmi_grp 4
bmi_grp	**5**	1	2.97439	0.33318	79.6955	<.0001	19.578	10.190	37.616	bmi_grp 5
motion_grp	**1**	1	0.42678	0.19096	4.9949	0.0254	1.532	1.054	2.228	motion_grp 1
sovn_grp	**0**	1	0.06114	0.19622	0.0971	0.7554	1.063	0.724	1.562	sovn_grp 0
sovn_grp	**2**	1	0.51835	0.26702	3.7684	0.0522	1.679	0.995	2.834	sovn_grp 2
alcohol_grp	**1**	1	0.10919	0.14112	0.5986	0.4391	1.115	0.846	1.471	alcohol_grp 1
alcohol_grp	**2**	1	-0.01357	0.59287	0.0005	0.9817	0.987	0.309	3.153	alcohol_grp 2
ryger_grp	**1**	1	0.08541	0.16255	0.2761	0.5993	1.089	0.792	1.498	ryger_grp 1
ryger_grp	**2**	1	0.43652	0.19882	4.8202	0.0281	1.547	1.048	2.285	ryger_grp 2
ryger_grp	**3**	1	1.05543	0.25477	17.1622	<.0001	2.873	1.744	4.734	ryger_grp 3
indkomst_grp	**1**	1	0.99412	0.29553	11.3156	0.0008	2.702	1.514	4.823	indkomst_grp 1
indkomst_grp	**2**	1	0.60362	0.23311	6.7050	0.0096	1.829	1.158	2.888	indkomst_grp 2
indkomst_grp	**3**	1	0.46015	0.20886	4.8538	0.0276	1.584	1.052	2.386	indkomst_grp 3
uddgr	**1**	1	-0.35031	0.19363	3.2732	0.0704	0.704	0.482	1.030	uddgr 1
uddgr	**2**	1	-0.31105	0.18066	2.9645	0.0851	0.733	0.514	1.044	uddgr 2

Appendix 2

Analysis of Maximum likelihood Estimates of Gender

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
cpss_grp	**1**	1	0.19216	0.12663	2.3027	0.1291	.	.	.	cpss_grp 1
cpss_grp	**2**	1	0.69119	0.39696	3.0318	0.0816	.	.	.	cpss_grp 2
C_KON	**K**	1	-0.23804	0.13051	3.3267	0.0682	.	.	.	Køn K
alder_grp	**1**	1	0.67304	0.37065	3.2973	0.0694	1.960	0.948	4.053	alder_grp 1
alder_grp	**2**	1	1.21838	0.32907	13.7089	0.0002	3.382	1.774	6.445	alder_grp 2
alder_grp	**3**	1	1.89806	0.31688	35.8781	<.0001	6.673	3.586	12.418	alder_grp 3
alder_grp	**4**	1	2.24558	0.31046	52.3179	<.0001	9.446	5.140	17.358	alder_grp 4
alder_grp	**5**	1	2.58391	0.30864	70.0905	<.0001	13.249	7.235	24.260	alder_grp 5
bmi_grp	**0**	1	0.53543	0.28917	3.4284	0.0641	1.708	0.969	3.011	bmi_grp 0
bmi_grp	**2**	1	0.88478	0.12878	47.2013	<.0001	2.422	1.882	3.118	bmi_grp 2
bmi_grp	**3**	1	1.55551	0.14328	117.8551	<.0001	4.737	3.578	6.274	bmi_grp 3
bmi_grp	**4**	1	2.32165	0.18082	164.8558	<.0001	10.192	7.151	14.528	bmi_grp 4
bmi_grp	**5**	1	2.96513	0.22395	175.2994	<.0001	19.397	12.506	30.086	bmi_grp 5
motion_grp	**1**	1	0.29313	0.11138	6.9266	0.0085	1.341	1.078	1.668	motion_grp 1
sovn_grp	**0**	1	0.18409	0.12711	2.0976	0.1475	1.202	0.937	1.542	sovn_grp 0
sovn_grp	**2**	1	0.46570	0.17602	6.9994	0.0082	1.593	1.128	2.249	sovn_grp 2
alcohol_grp	**1**	1	0.07619	0.09685	0.6189	0.4315	1.079	0.893	1.305	alcohol_grp 1
alcohol_grp	**2**	1	-0.42978	0.28937	2.2059	0.1375	0.651	0.369	1.147	alcohol_grp 2
ryger_grp	**1**	1	0.15711	0.10563	2.2121	0.1369	1.170	0.951	1.439	ryger_grp 1
ryger_grp	**2**	1	0.19144	0.14829	1.6666	0.1967	1.211	0.906	1.619	ryger_grp 2
ryger_grp	**3**	1	0.66896	0.15622	18.3370	<.0001	1.952	1.437	2.652	ryger_grp 3
indkomst_grp	**1**	1	0.47782	0.20282	5.5502	0.0185	1.613	1.084	2.400	indkomst_grp 1
indkomst_grp	**2**	1	0.28539	0.14373	3.9425	0.0471	1.330	1.004	1.763	indkomst_grp 2
indkomst_grp	**3**	1	0.23425	0.12434	3.5489	0.0596	1.264	0.991	1.613	indkomst_grp 3
uddgr	**1**	1	0.00801	0.13219	0.0037	0.9517	1.008	0.778	1.306	uddgr 1
uddgr	**2**	1	-0.09657	0.12360	0.6105	0.4346	0.908	0.713	1.157	uddgr 2

Analysis of Maximum Likelihood Estimates

Parameter			DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
cpss_grp*C_KON	**1**	**K**	1	0.26701	0.18662	2.0471	0.1525	.	.	.	cpss_grp 1 * Køn K
cpss_grp*C_KON	**2**	**K**	1	0.09981	0.53593	0.0347	0.8523	.	.	.	cpss_grp 2 * Køn K

Analysis of Maximum likelihood Estimates of Age

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
cpss_grp	**1**	1	0.77923	0.58625	1.7668	0.1838	.	.	.	cpss_grp 1
cpss_grp	**2**	1	0.78825	1.09904	0.5144	0.4732	.	.	.	cpss_grp 2
C_KON	**K**	1	-0.12924	0.09970	1.6805	0.1949	0.879	0.723	1.068	Køn K
alder_grp	**1**	1	0.80141	0.56076	2.0424	0.1530	.	.	.	alder_grp 1
alder_grp	**2**	1	1.39579	0.49943	7.8108	0.0052	.	.	.	alder_grp 2
alder_grp	**3**	1	2.05340	0.48298	18.0756	<.0001	.	.	.	alder_grp 3
alder_grp	**4**	1	2.56911	0.47259	29.5523	<.0001	.	.	.	alder_grp 4
alder_grp	**5**	1	2.77513	0.47647	33.9233	<.0001	.	.	.	alder_grp 5
bmi_grp	**0**	1	0.54804	0.28921	3.5908	0.0581	1.730	0.981	3.049	bmi_grp 0
bmi_grp	**2**	1	0.88840	0.12878	47.5882	<.0001	2.431	1.889	3.129	bmi_grp 2
bmi_grp	**3**	1	1.55855	0.14327	118.3359	<.0001	4.752	3.589	6.292	bmi_grp 3
bmi_grp	**4**	1	2.31136	0.18109	162.9048	<.0001	10.088	7.074	14.387	bmi_grp 4
bmi_grp	**5**	1	2.96234	0.22516	173.1028	<.0001	19.343	12.442	30.073	bmi_grp 5
motion_grp	**1**	1	0.28741	0.11119	6.6816	0.0097	1.333	1.072	1.658	motion_grp 1
sovn_grp	**0**	1	0.18001	0.12754	1.9922	0.1581	1.197	0.932	1.537	sovn_grp 0
sovn_grp	**2**	1	0.46776	0.17585	7.0759	0.0078	1.596	1.131	2.253	sovn_grp 2
alcohol_grp	**1**	1	0.06703	0.09694	0.4781	0.4893	1.069	0.884	1.293	alcohol_grp 1
alcohol_grp	**2**	1	-0.43558	0.28851	2.2794	0.1311	0.647	0.367	1.139	alcohol_grp 2
ryger_grp	**1**	1	0.15785	0.10558	2.2353	0.1349	1.171	0.952	1.440	ryger_grp 1
ryger_grp	**2**	1	0.19439	0.14836	1.7167	0.1901	1.215	0.908	1.624	ryger_grp 2
ryger_grp	**3**	1	0.66111	0.15636	17.8764	<.0001	1.937	1.426	2.632	ryger_grp 3
indkomst_grp	**1**	1	0.46888	0.20282	5.3446	0.0208	1.598	1.074	2.378	indkomst_grp 1
indkomst_grp	**2**	1	0.27752	0.14354	3.7380	0.0532	1.320	0.996	1.749	indkomst_grp 2
indkomst_grp	**3**	1	0.22634	0.12450	3.3052	0.0691	1.254	0.982	1.601	indkomst_grp 3
uddgr	**1**	1	0.01776	0.13218	0.0181	0.8931	1.018	0.786	1.319	uddgr 1

Analysis of Maximum Likelihood Estimates

Parameter			DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
uddgr	**2**		1	-0.09285	0.12359	0.5644	0.4525	0.911	0.715	1.161	uddgr 2
cpss_grp*alder_grp	**1**	**1**	1	-0.33860	0.74453	0.2068	0.6493	.	.	.	cpss_grp 1 * alder_grp 1
cpss_grp*alder_grp	**1**	**2**	1	-0.35941	0.64439	0.3111	0.5770	.	.	.	cpss_grp 1 * alder_grp 2
cpss_grp*alder_grp	**1**	**3**	1	-0.34787	0.61656	0.3183	0.5726	.	.	.	cpss_grp 1 * alder_grp 3
cpss_grp*alder_grp	**1**	**4**	1	-0.73340	0.60929	1.4489	0.2287	.	.	.	cpss_grp 1 * alder_grp 4
cpss_grp*alder_grp	**1**	**5**	1	-0.36912	0.61241	0.3633	0.5467	.	.	.	cpss_grp 1 * alder_grp 5
cpss_grp*alder_grp	**2**	**1**	1	0.50235	1.34290	0.1399	0.7083	.	.	.	cpss_grp 2 * alder_grp 1
cpss_grp*alder_grp	**2**	**2**	1	-0.01194	1.25426	0.0001	0.9924	.	.	.	cpss_grp 2 * alder_grp 2
cpss_grp*alder_grp	**2**	**3**	1	0.33366	1.17977	0.0800	0.7773	.	.	.	cpss_grp 2 * alder_grp 3
cpss_grp*alder_grp	**2**	**4**	1	-0.46310	1.31081	0.1248	0.7239	.	.	.	cpss_grp 2 * alder_grp 4
cpss_grp*alder_grp	**2**	**5**	1	-0.91967	1.49067	0.3806	0.5373	.	.	.	cpss_grp 2 * alder_grp 5

Analysis of Maximum likelihood Estimates of BMI

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
cpss_grp	**1**	1	0.54430	0.21807	6.2299	0.0126	.	.	.	cpss_grp 1
cpss_grp	**2**	1	1.10901	0.59876	3.4306	0.0640	.	.	.	cpss_grp 2
C_KON	**K**	1	-0.11905	0.09973	1.4249	0.2326	0.888	0.730	1.079	Køn K
alder_grp	**1**	1	0.65993	0.37082	3.1671	0.0751	1.935	0.935	4.002	alder_grp 1
alder_grp	**2**	1	1.18145	0.32913	12.8851	0.0003	3.259	1.710	6.212	alder_grp 2
alder_grp	**3**	1	1.86216	0.31658	34.5999	<.0001	6.438	3.461	11.973	alder_grp 3
alder_grp	**4**	1	2.21162	0.31015	50.8481	<.0001	9.130	4.972	16.768	alder_grp 4
alder_grp	**5**	1	2.54943	0.30824	68.4087	<.0001	12.800	6.996	23.420	alder_grp 5
bmi_grp	**0**	1	0.40341	0.47126	0.7328	0.3920	.	.	.	bmi_grp 0
bmi_grp	**2**	1	1.03482	0.17203	36.1827	<.0001	.	.	.	bmi_grp 2
bmi_grp	**3**	1	1.69289	0.19317	76.7997	<.0001	.	.	.	bmi_grp 3
bmi_grp	**4**	1	2.43962	0.25644	90.5021	<.0001	.	.	.	bmi_grp 4
bmi_grp	**5**	1	3.07431	0.31548	94.9602	<.0001	.	.	.	bmi_grp 5
motion_grp	**1**	1	0.28880	0.11131	6.7320	0.0095	1.335	1.073	1.660	motion_grp 1
sovn_grp	**0**	1	0.18757	0.12702	2.1805	0.1398	1.206	0.940	1.547	sovn_grp 0
sovn_grp	**2**	1	0.47420	0.17597	7.2622	0.0070	1.607	1.138	2.268	sovn_grp 2
alcohol_grp	**1**	1	0.07528	0.09694	0.6031	0.4374	1.078	0.892	1.304	alcohol_grp 1
alcohol_grp	**2**	1	-0.42148	0.28777	2.1452	0.1430	0.656	0.373	1.153	alcohol_grp 2
ryger_grp	**1**	1	0.15646	0.10568	2.1919	0.1387	1.169	0.951	1.438	ryger_grp 1
ryger_grp	**2**	1	0.18418	0.14847	1.5389	0.2148	1.202	0.899	1.608	ryger_grp 2
ryger_grp	**3**	1	0.67998	0.15631	18.9251	<.0001	1.974	1.453	2.681	ryger_grp 3
indkomst_grp	**1**	1	0.45489	0.20318	5.0125	0.0252	1.576	1.058	2.347	indkomst_grp 1
indkomst_grp	**2**	1	0.28306	0.14341	3.8959	0.0484	1.327	1.002	1.758	indkomst_grp 2
indkomst_grp	**3**	1	0.22724	0.12436	3.3390	0.0677	1.255	0.984	1.602	indkomst_grp 3
uddgr	**1**	1	0.01444	0.13209	0.0119	0.9130	1.015	0.783	1.314	uddgr 1

Analysis of Maximum likelihood Estimates of Income

Analysis of Maximum Likelihood Estimates

Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
cpss_grp	**1**	1	0.45933	0.19335	5.6436	0.0175	.	.	.	cpss_grp 1
cpss_grp	**2**	1	1.57474	0.51738	9.2639	0.0023	.	.	.	cpss_grp 2
C_KON	**K**	1	-0.12293	0.09966	1.5216	0.2174	0.884	0.727	1.075	Køn K
alder_grp	**1**	1	0.66036	0.37211	3.1492	0.0760	1.935	0.933	4.014	alder_grp 1
alder_grp	**2**	1	1.21360	0.33059	13.4762	0.0002	3.366	1.761	6.434	alder_grp 2
alder_grp	**3**	1	1.89091	0.31835	35.2804	<.0001	6.625	3.550	12.365	alder_grp 3
alder_grp	**4**	1	2.23995	0.31184	51.5962	<.0001	9.393	5.098	17.308	alder_grp 4
alder_grp	**5**	1	2.57249	0.31002	68.8528	<.0001	13.098	7.134	24.050	alder_grp 5
bmi_grp	**0**	1	0.54332	0.28911	3.5317	0.0602	1.722	0.977	3.034	bmi_grp 0
bmi_grp	**2**	1	0.89038	0.12876	47.8146	<.0001	2.436	1.893	3.135	bmi_grp 2
bmi_grp	**3**	1	1.55656	0.14331	117.9725	<.0001	4.742	3.581	6.280	bmi_grp 3
bmi_grp	**4**	1	2.32560	0.18090	165.2791	<.0001	10.233	7.178	14.587	bmi_grp 4
bmi_grp	**5**	1	2.97861	0.22403	176.7799	<.0001	19.661	12.674	30.499	bmi_grp 5
motion_grp	**1**	1	0.28593	0.11135	6.5935	0.0102	1.331	1.070	1.656	motion_grp
sovn_grp	**0**	1	0.18931	0.12703	2.2210	0.1361	1.208	0.942	1.550	sovn_grp 0
sovn_grp	**2**	1	0.47167	0.17576	7.2014	0.0073	1.603	1.136	2.262	sovn_grp 2
alcohol_grp	**1**	1	0.07755	0.09697	0.6395	0.4239	1.081	0.894	1.307	alcohol_grp
alcohol_grp	**2**	1	-0.42074	0.28817	2.1317	0.1443	0.657	0.373	1.155	alcohol_grp
ryger_grp	**1**	1	0.15942	0.10565	2.2769	0.1313	1.173	0.953	1.443	ryger_grp 1
ryger_grp	**2**	1	0.19613	0.14834	1.7480	0.1861	1.217	0.910	1.627	ryger_grp 2
ryger_grp	**3**	1	0.67728	0.15626	18.7857	<.0001	1.969	1.449	2.674	ryger_grp 3
ndkomst_grp	**1**	1	0.45005	0.26984	2.7817	0.0953	.	.	.	indkomst_gr 1
ndkomst_grp	**2**	1	0.36210	0.17798	4.1389	0.0419	.	.	.	indkomst_gr 2
ndkomst_grp	**3**	1	0.35963	0.15513	5.3742	0.0204	.	.	.	indkomst_gr 3
uddgr	**1**	1	0.01407	0.13209	0.0114	0.9151	1.014	0.783	1.314	uddgr 1

Analysis of Maximum Likelihood Estimates

Parameter			DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
uddgr	2		1	-0.10066	0.12361	0.6632	0.4154	0.904	0.710	1.152	uddgr 2
cpss_grp*indkomst_gr	1	1	1	0.01305	0.36188	0.0013	0.9712	.	.	.	cpss_grp 1 * indkomst_gr 1
cpss_grp*indkomst_gr	1	2	1	-0.15192	0.25021	0.3687	0.5437	.	.	.	cpss_grp 1 * indkomst_gr 2
cpss_grp*indkomst_gr	1	3	1	-0.29828	0.24937	1.4307	0.2317	.	.	.	cpss_grp 1 * indkomst_gr 3
cpss_grp*indkomst_gr	2	1	1	-0.55438	0.90710	0.3735	0.5411	.	.	.	cpss_grp 2 * indkomst_gr 1
cpss_grp*indkomst_gr	2	2	1	-1.24406	0.72948	2.9084	0.0881	.	.	.	cpss_grp 2 * indkomst_gr 2
cpss_grp*indkomst_gr	2	3	1	-1.04757	0.68959	2.3077	0.1287	.	.	.	cpss_grp 2 * indkomst_gr 3

Analysis of Maximum likelihood Estimates of Educational Status

Analysis of Maximum Likelihood Estimates

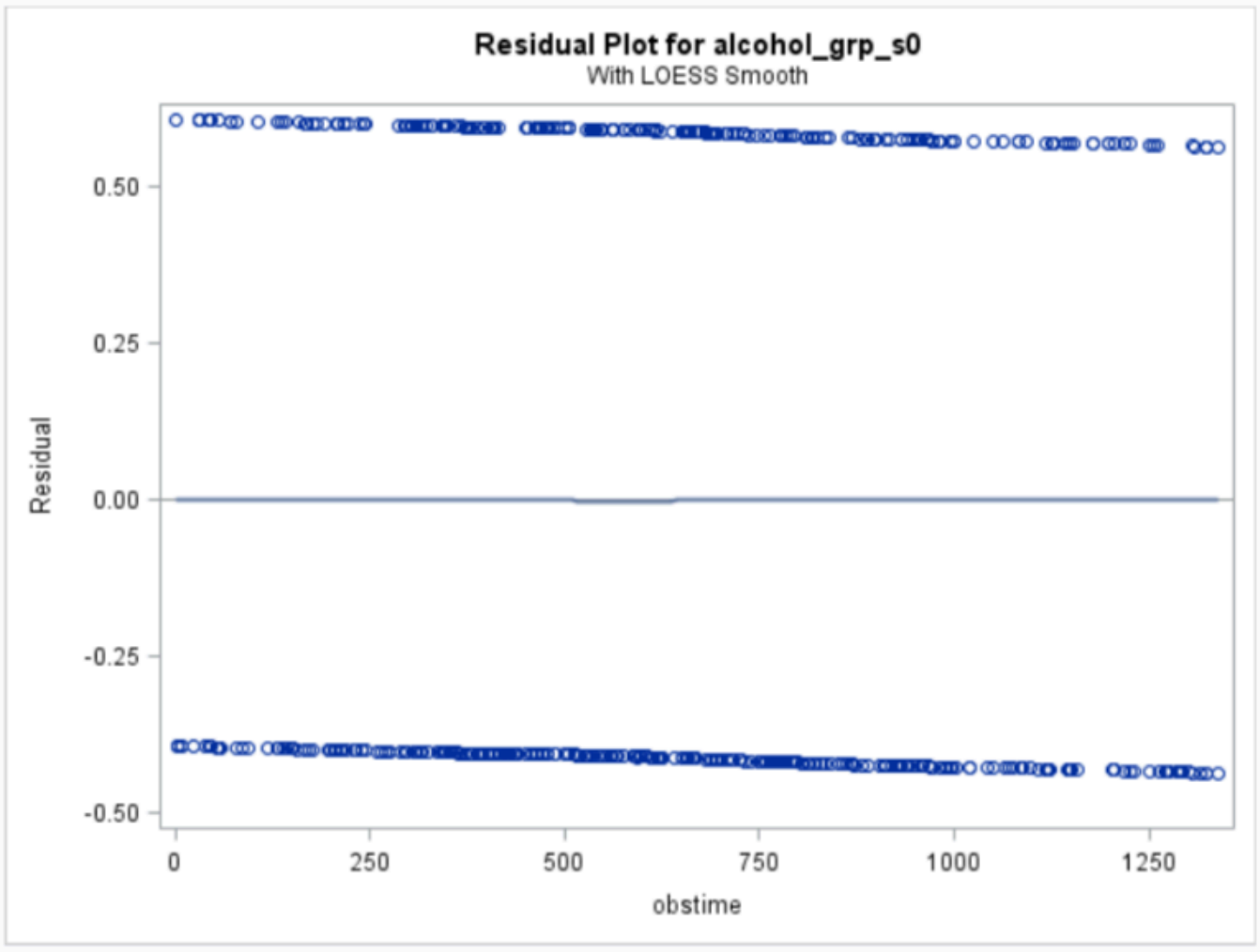
Parameter		DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
cpss_grp	**1**	1	0.70457	0.20243	12.1142	0.0005	.	.	.	cpss_grp 1
cpss_grp	**2**	1	1.37316	0.59671	5.2956	0.0214	.	.	.	cpss_grp 2
C_KON	**K**	1	-0.11914	0.09981	1.4250	0.2326	0.888	0.730	1.079	Køn K
alder_grp	**1**	1	0.67047	0.37069	3.2714	0.0705	1.955	0.945	4.043	alder_grp 1
alder_grp	**2**	1	1.21816	0.32899	13.7104	0.0002	3.381	1.774	6.443	alder_grp 2
alder_grp	**3**	1	1.90106	0.31697	35.9717	<.0001	6.693	3.596	12.457	alder_grp 3
alder_grp	**4**	1	2.25459	0.31049	52.7293	<.0001	9.531	5.186	17.516	alder_grp 4
alder_grp	**5**	1	2.59582	0.30885	70.6429	<.0001	13.408	7.319	24.561	alder_grp 5
bmi_grp	**0**	1	0.54155	0.28905	3.5101	0.0610	1.719	0.975	3.029	bmi_grp 0
bmi_grp	**2**	1	0.89268	0.12882	48.0211	<.0001	2.442	1.897	3.143	bmi_grp 2
bmi_grp	**3**	1	1.56025	0.14329	118.5652	<.0001	4.760	3.595	6.303	bmi_grp 3
bmi_grp	**4**	1	2.32776	0.18080	165.7658	<.0001	10.255	7.195	14.616	bmi_grp 4
bmi_grp	**5**	1	2.97065	0.22368	176.3798	<.0001	19.505	12.582	30.237	bmi_grp 5
motion_grp	**1**	1	0.29158	0.11123	6.8717	0.0088	1.339	1.076	1.665	motion_grp 1
sovn_grp	**0**	1	0.18561	0.12699	2.1365	0.1438	1.204	0.939	1.544	sovn_grp 0
sovn_grp	**2**	1	0.46338	0.17598	6.9333	0.0085	1.589	1.126	2.244	sovn_grp 2
alcohol_grp	**1**	1	0.07935	0.09696	0.6697	0.4132	1.083	0.895	1.309	alcohol_grp 1
alcohol_grp	**2**	1	-0.42164	0.28821	2.1403	0.1435	0.656	0.373	1.154	alcohol_grp 2
ryger_grp	**1**	1	0.15899	0.10566	2.2641	0.1324	1.172	0.953	1.442	ryger_grp 1
ryger_grp	**2**	1	0.20387	0.14830	1.8899	0.1692	1.226	0.917	1.640	ryger_grp 2
ryger_grp	**3**	1	0.67829	0.15626	18.8426	<.0001	1.971	1.451	2.677	ryger_grp 3
indkomst_grp	**1**	1	0.47487	0.20247	5.5011	0.0190	1.608	1.081	2.391	indkomst_grp 1
indkomst_grp	**2**	1	0.27479	0.14321	3.6817	0.0550	1.316	0.994	1.743	indkomst_grp 2
indkomst_grp	**3**	1	0.22399	0.12421	3.2522	0.0713	1.251	0.981	1.596	indkomst_grp 3
uddgr	**1**	1	0.26573	0.17001	2.4432	0.1180	.	.	.	uddgr 1

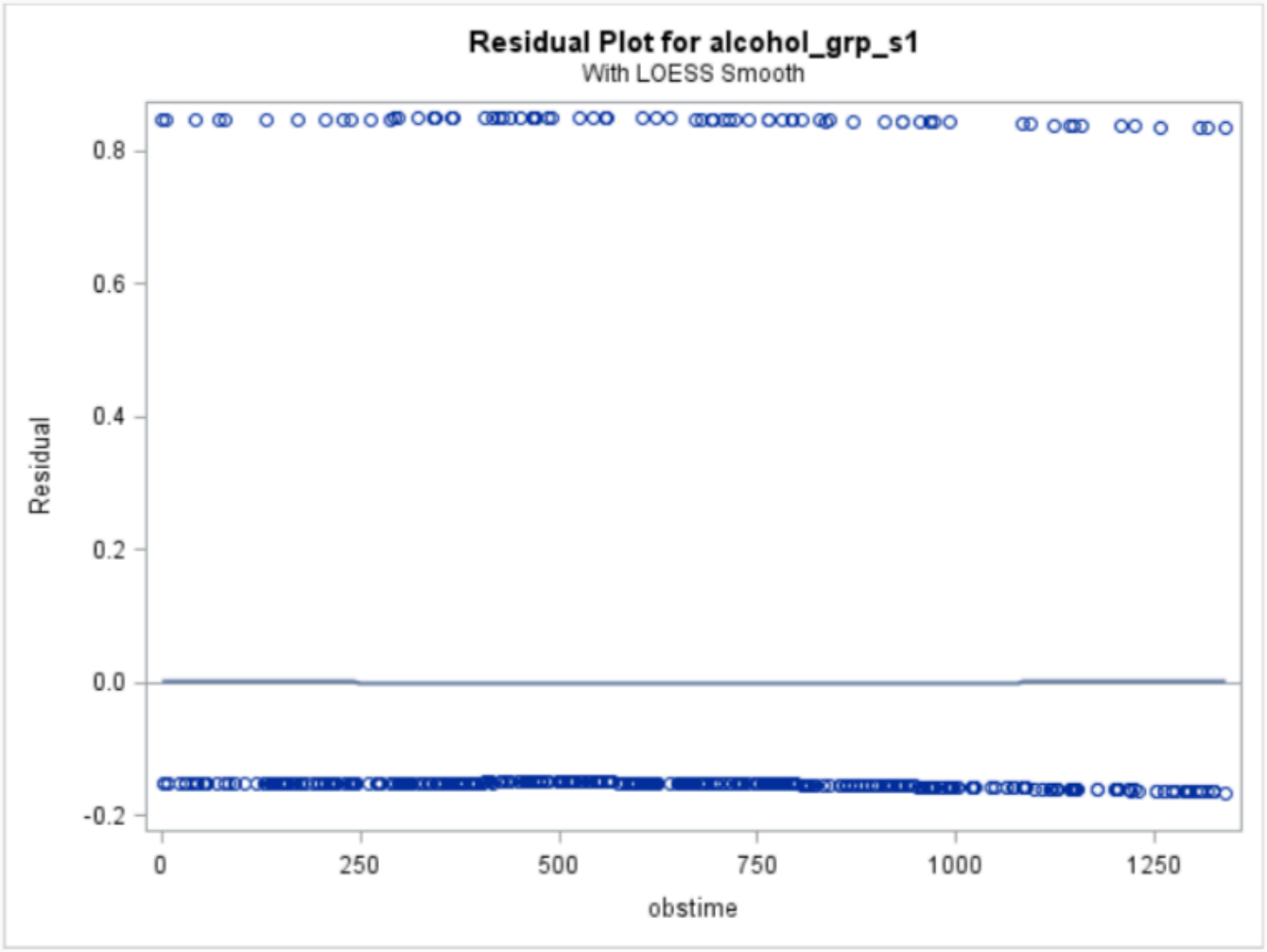
Analysis of Maximum Likelihood Estimates

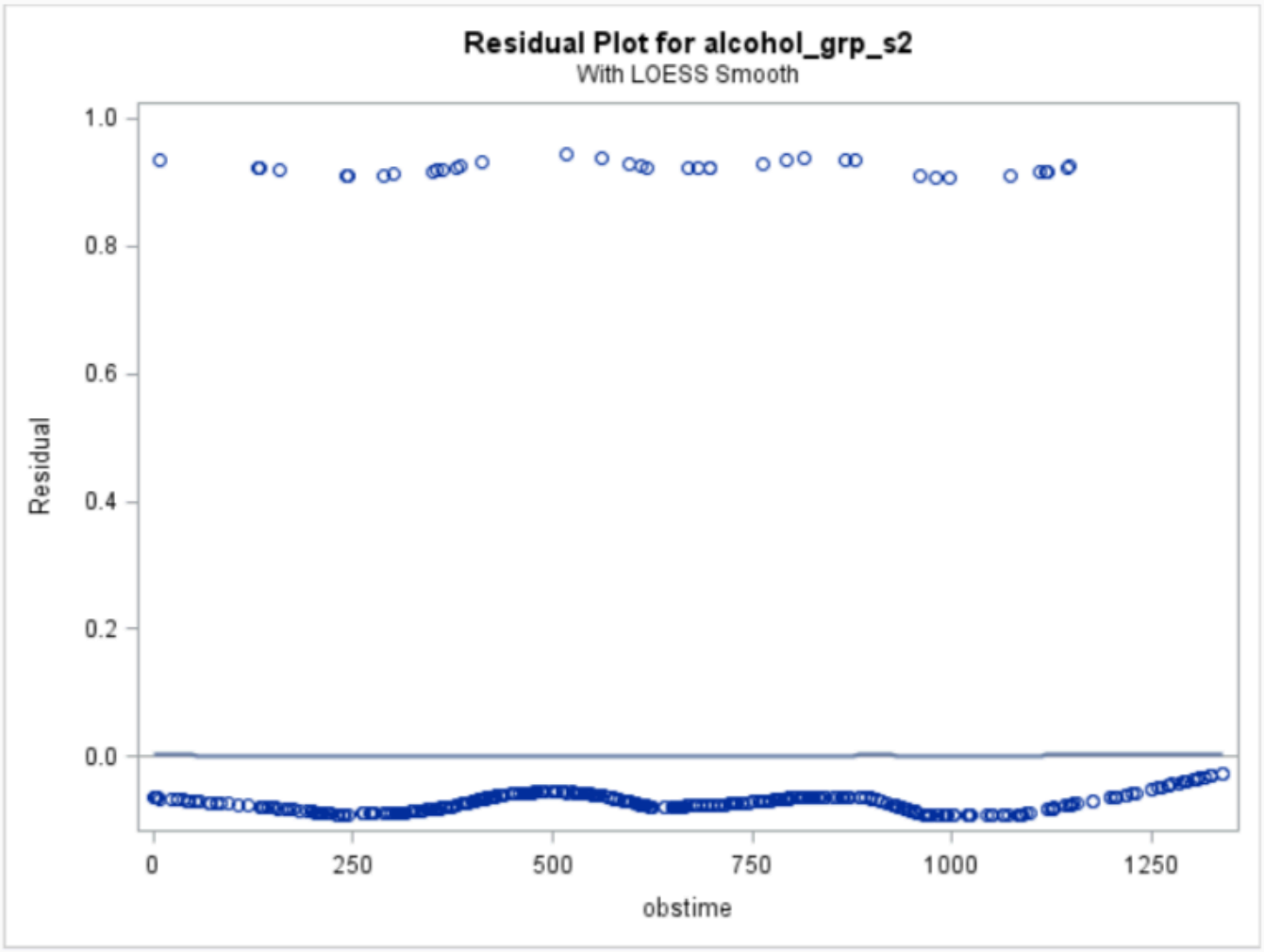
Parameter			DF	Parameter Estimate	Standard Error	Chi-Square	Pr > ChiSq	Hazard Ratio	95% Hazard Ratio Confidence Limits		Label
uddgr	**2**		1	0.06147	0.16046	0.1468	0.7017	.	.	.	uddgr 2
cpss_grp*uddgr	**1**	**1**	1	-0.58256	0.25002	5.4292	0.0198	.	.	.	cpss_grp 1 * uddgr 1
cpss_grp*uddgr	**1**	**2**	1	-0.41557	0.24754	2.8184	0.0932	.	.	.	cpss_grp 1 * uddgr 2
cpss_grp*uddgr	**2**	**1**	1	-1.03371	0.72835	2.0143	0.1558	.	.	.	cpss_grp 2 * uddgr 1
cpss_grp*uddgr	**2**	**2**	1	-0.49860	0.72710	0.4702	0.4929	.	.	.	cpss_grp 2 * uddgr 2

Appendix 3

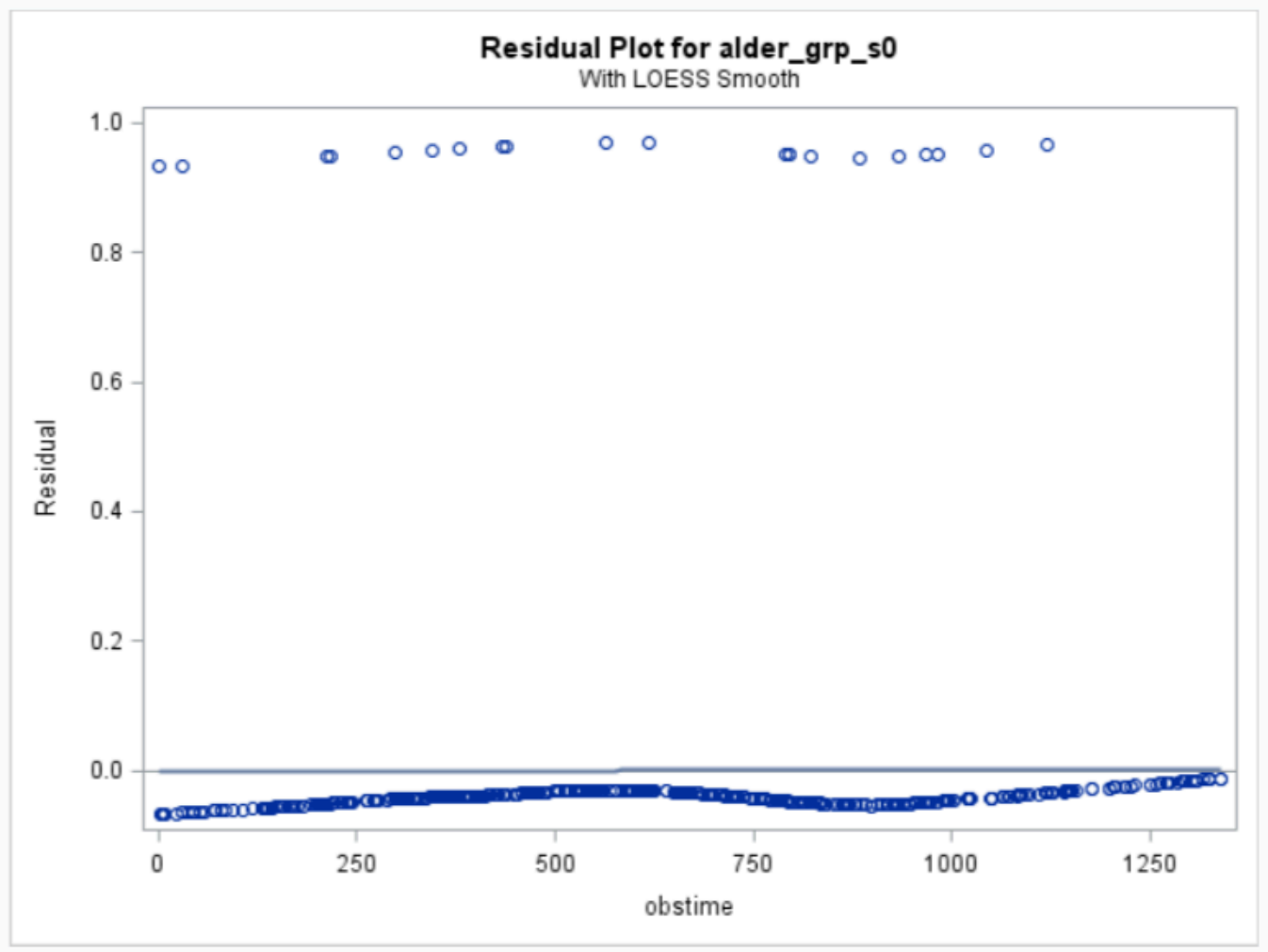
Schoenfeld residual plots of Alcohol

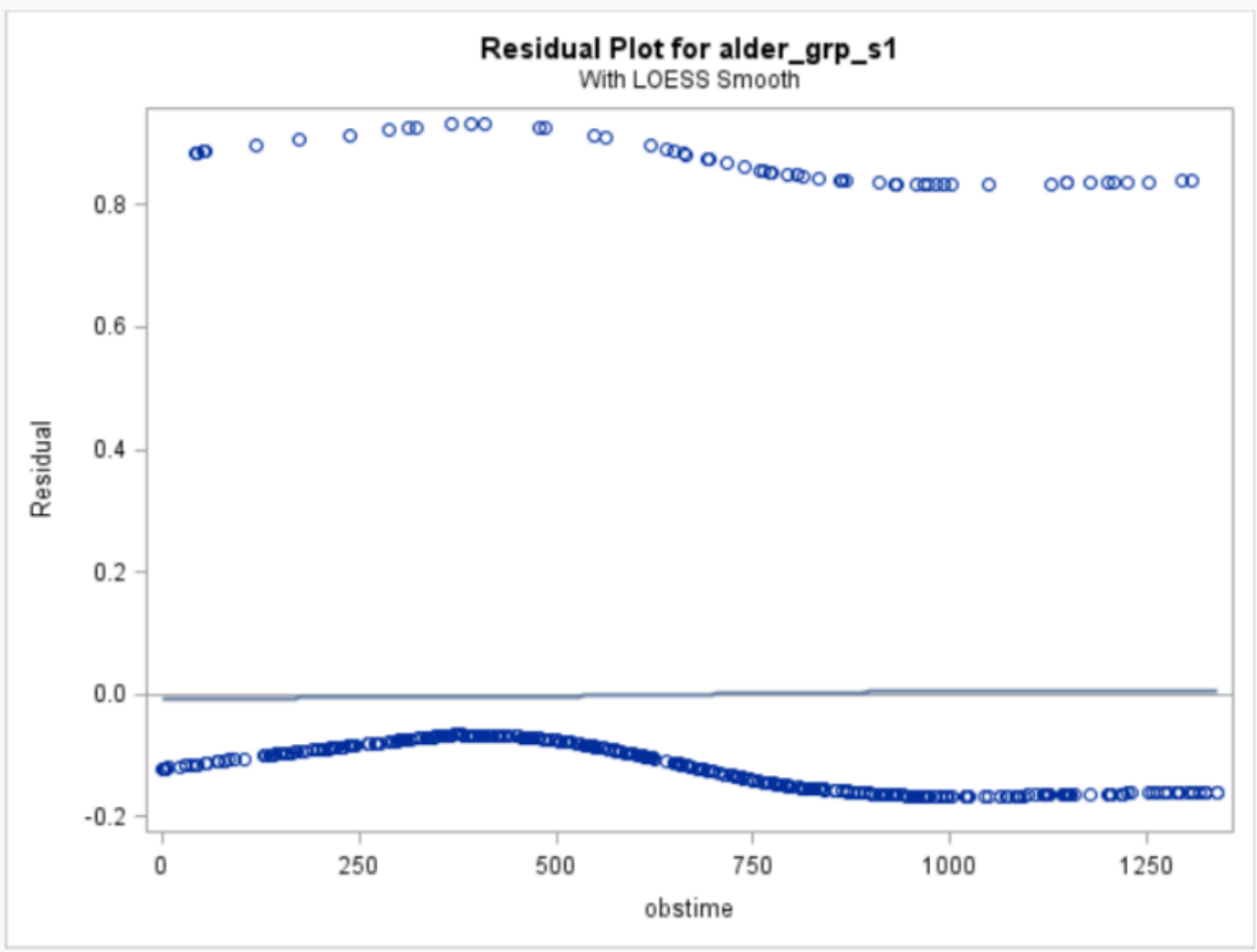


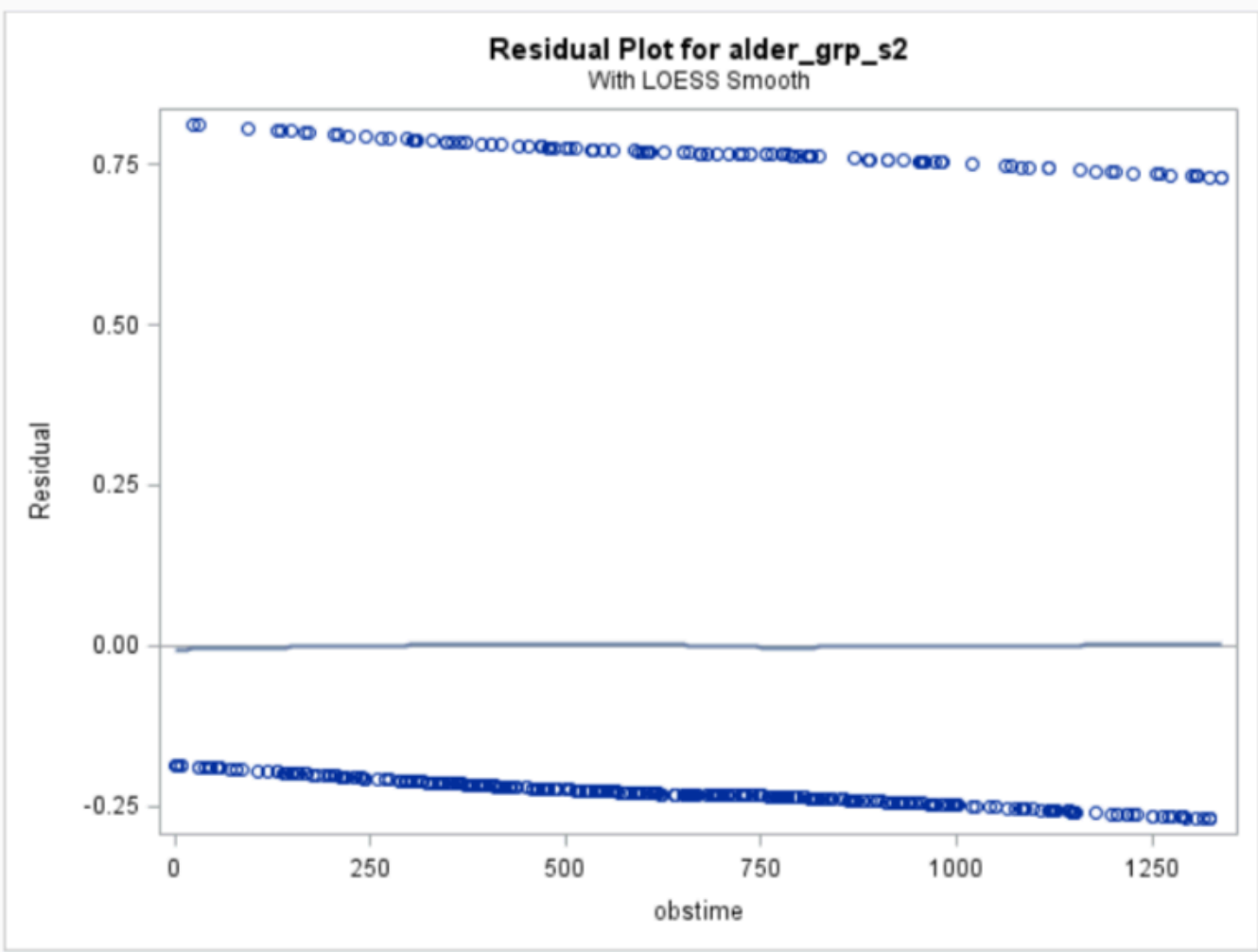

Residual Plot for alcohol_grp_s1
With LOESS Smooth
Residual
0.8
0.6
0.4
0.2
0.0
-0.2
0
250
500
750
1000
1250
obstime

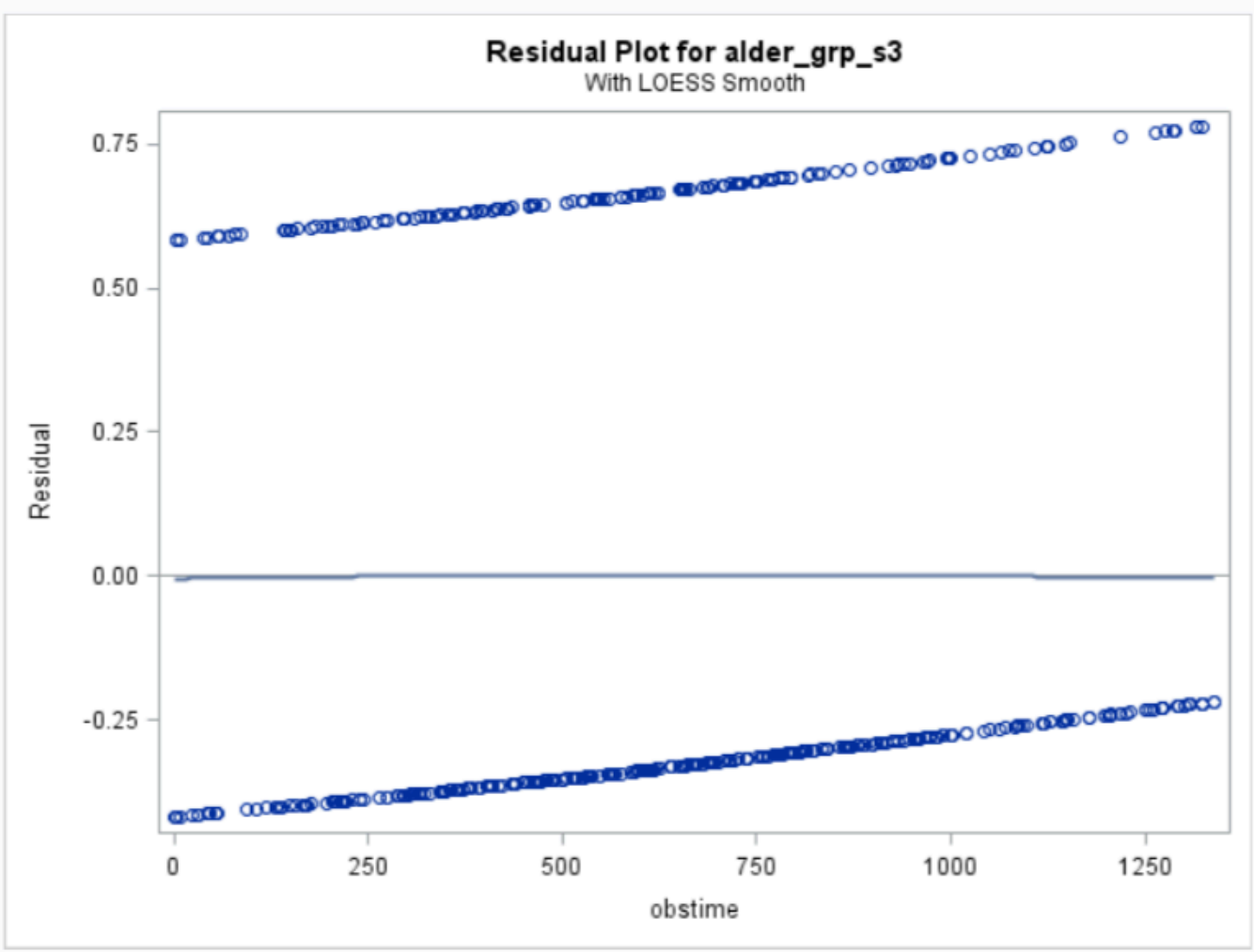

Residual Plot for alcohol_grp_s2
With LOESS Smooth
Residual
1.0
0.8
0.6
0.4
0.2
0.0
0
250
500
750
1000
1250
obstime

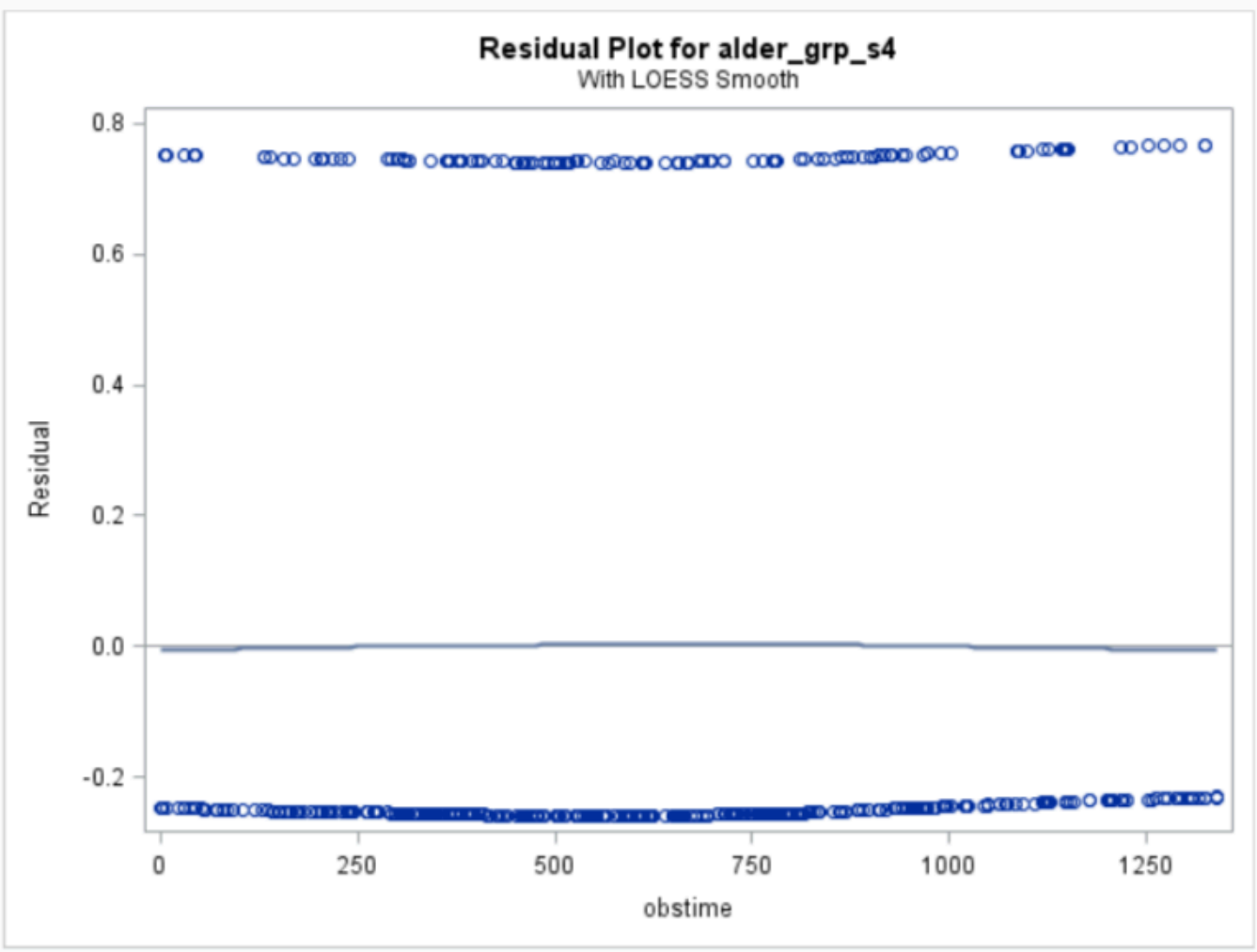
Schoenfeld residual plots of Age

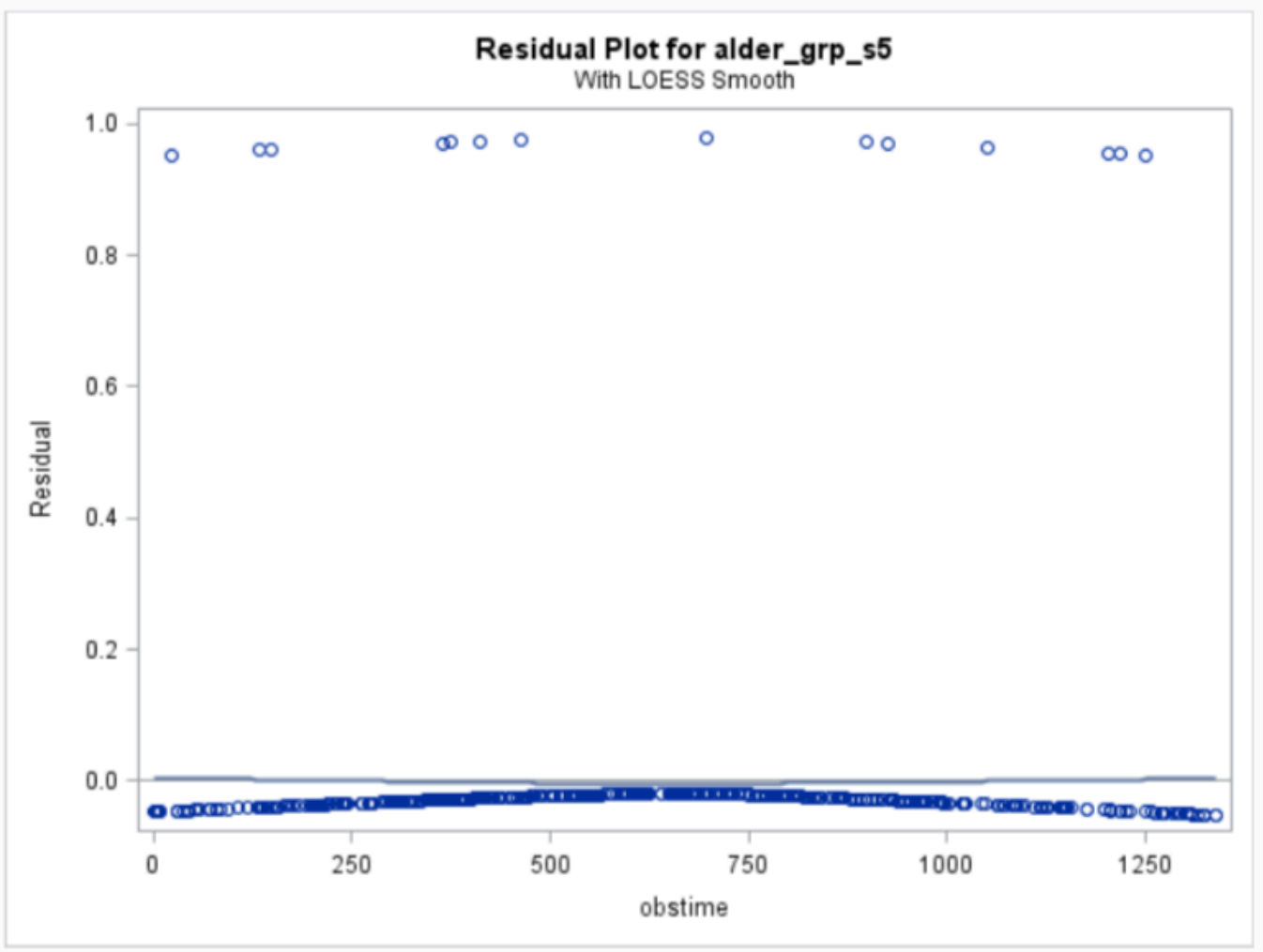



Residual Plot for alder_grp_s1
With LOESS Smooth
Residual
0.8
0.6
0.4
0.2
0.0
-0.2
0
250
500
750
1000
1250
obstime

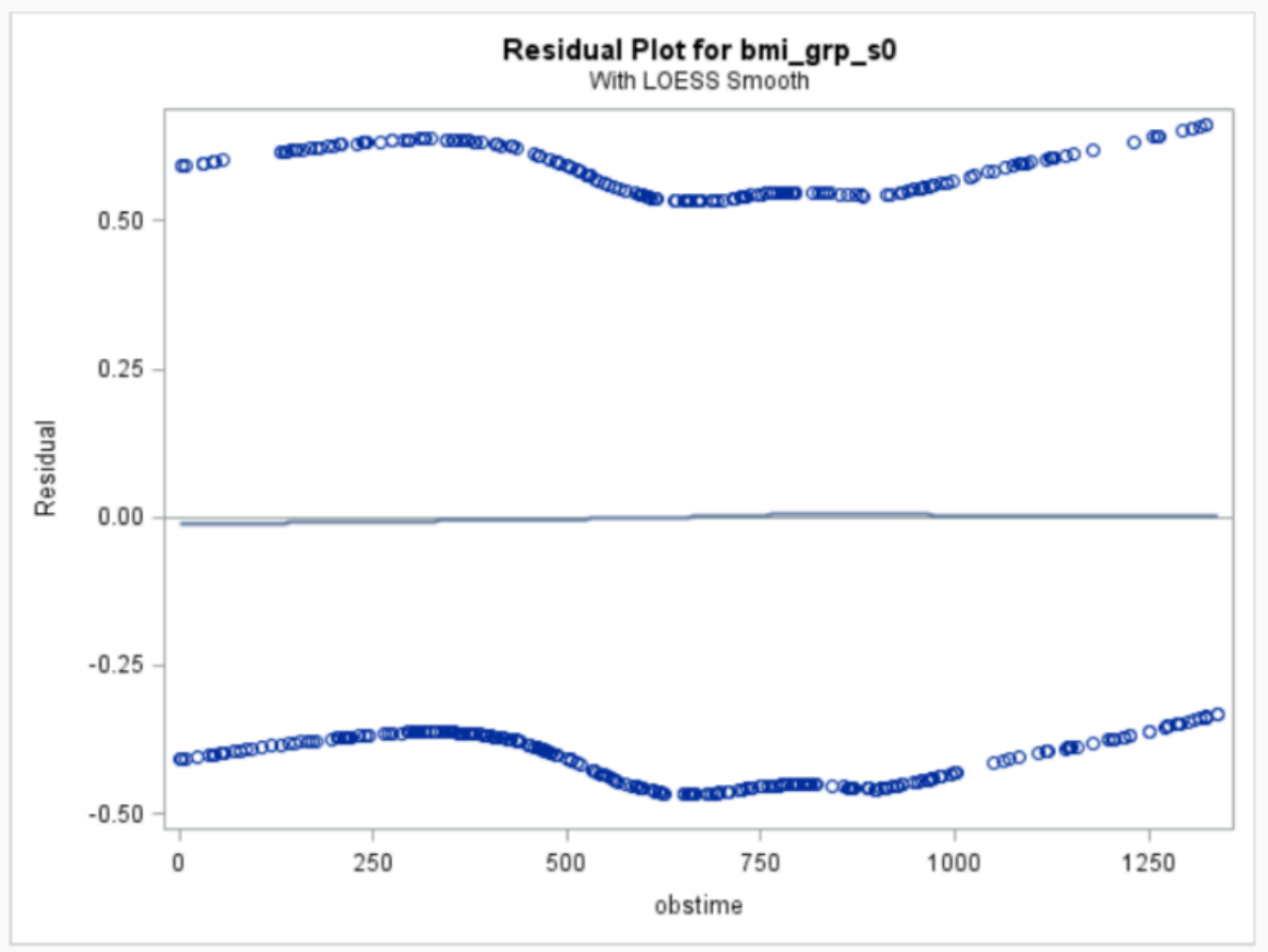

Residual Plot for alder_grp_s2
With LOESS Smooth
Residual
0.75
0.50
0.25
0.00
-0.25
0
250
500
750
1000
1250
obstime

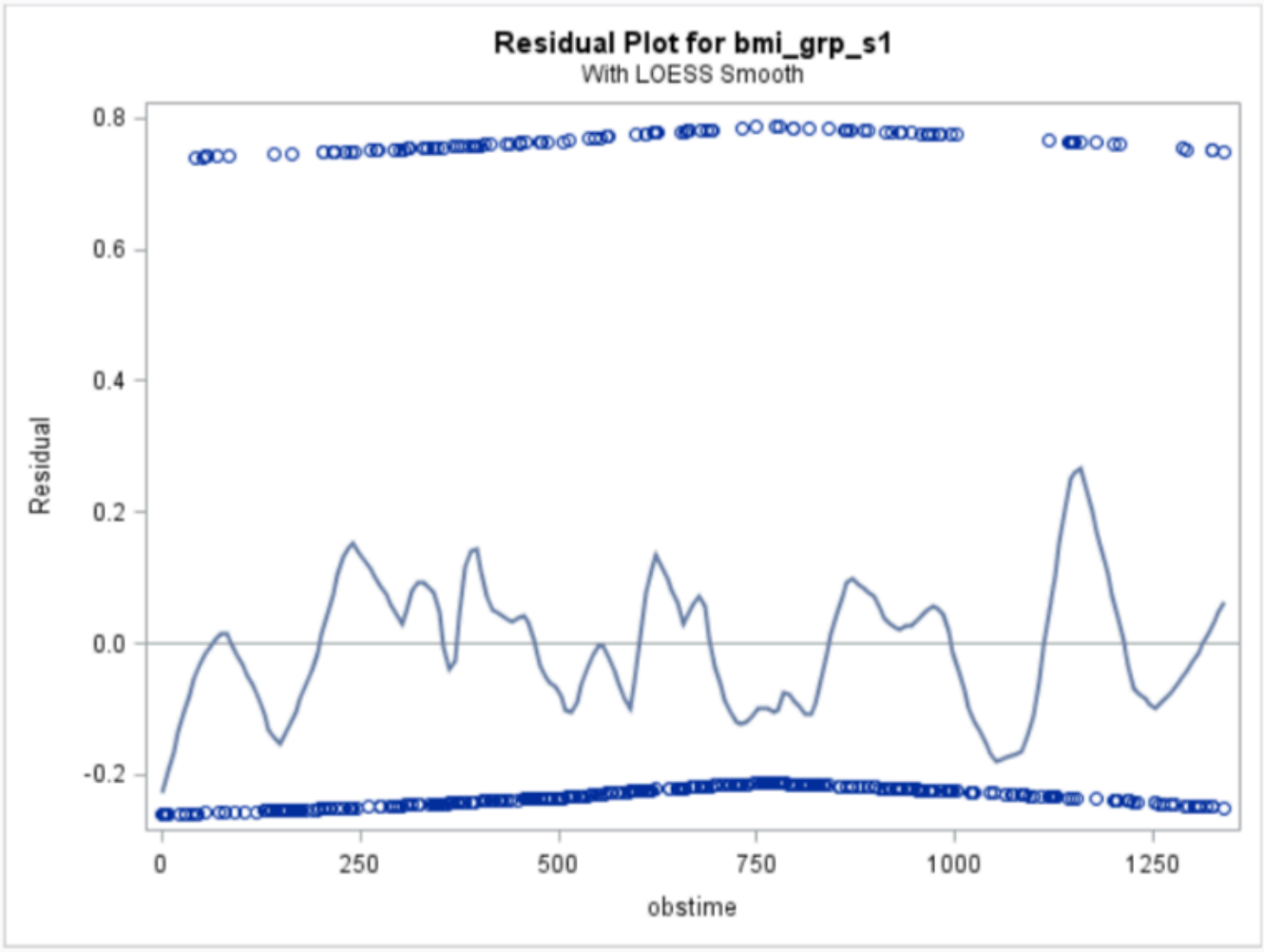

Residual Plot for alder_grp_s3
With LOESS Smooth
Residual
0.75
0.50
0.25
0.00
-0.25
0
250
500
750
1000
1250
obstime

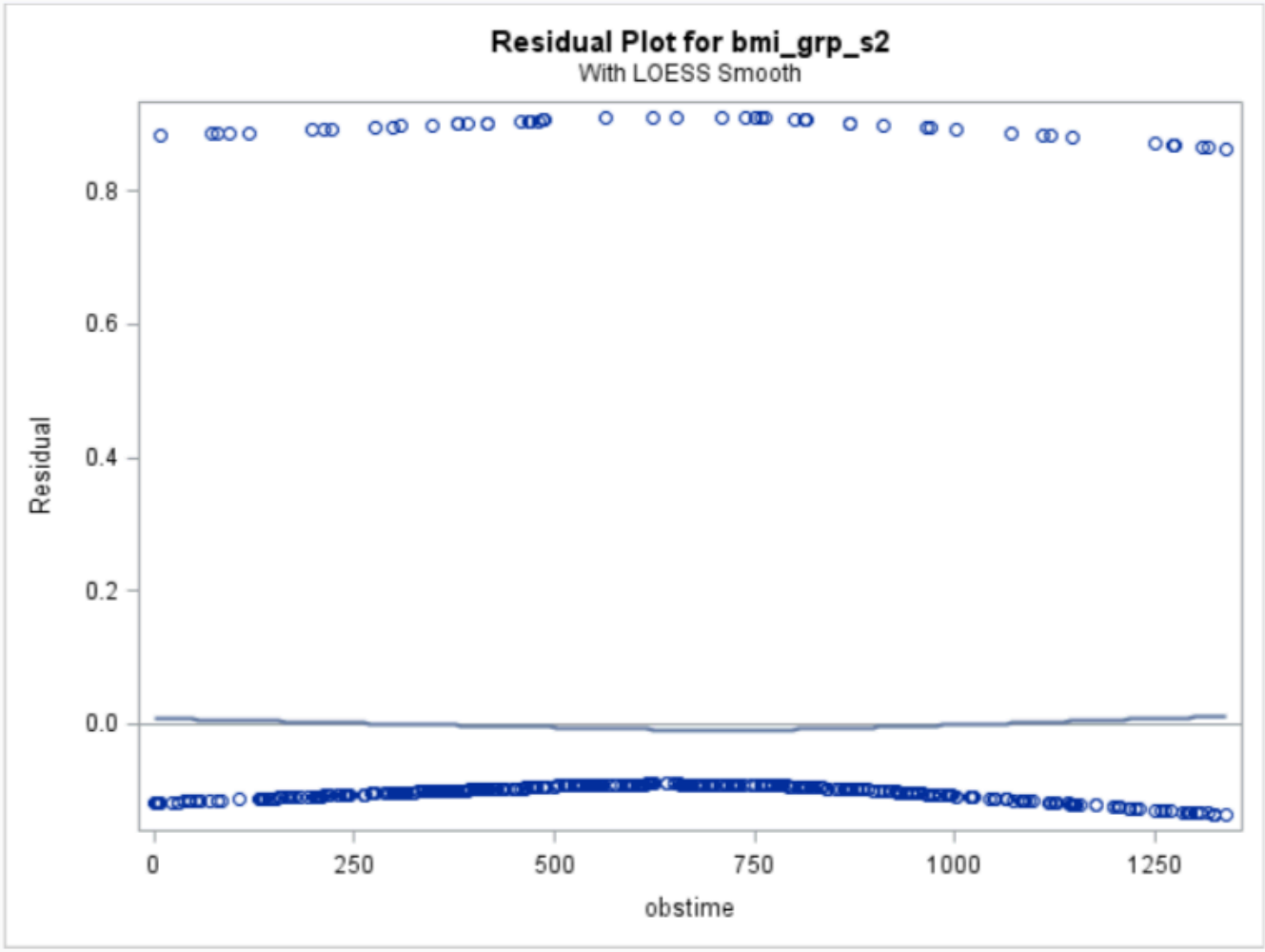

Residual Plot for alder_grp_s4
With LOESS Smooth
Residual
0.8
0.6
0.4
0.2
0.0
-0.2
0
250
500
750
1000
1250
obstime

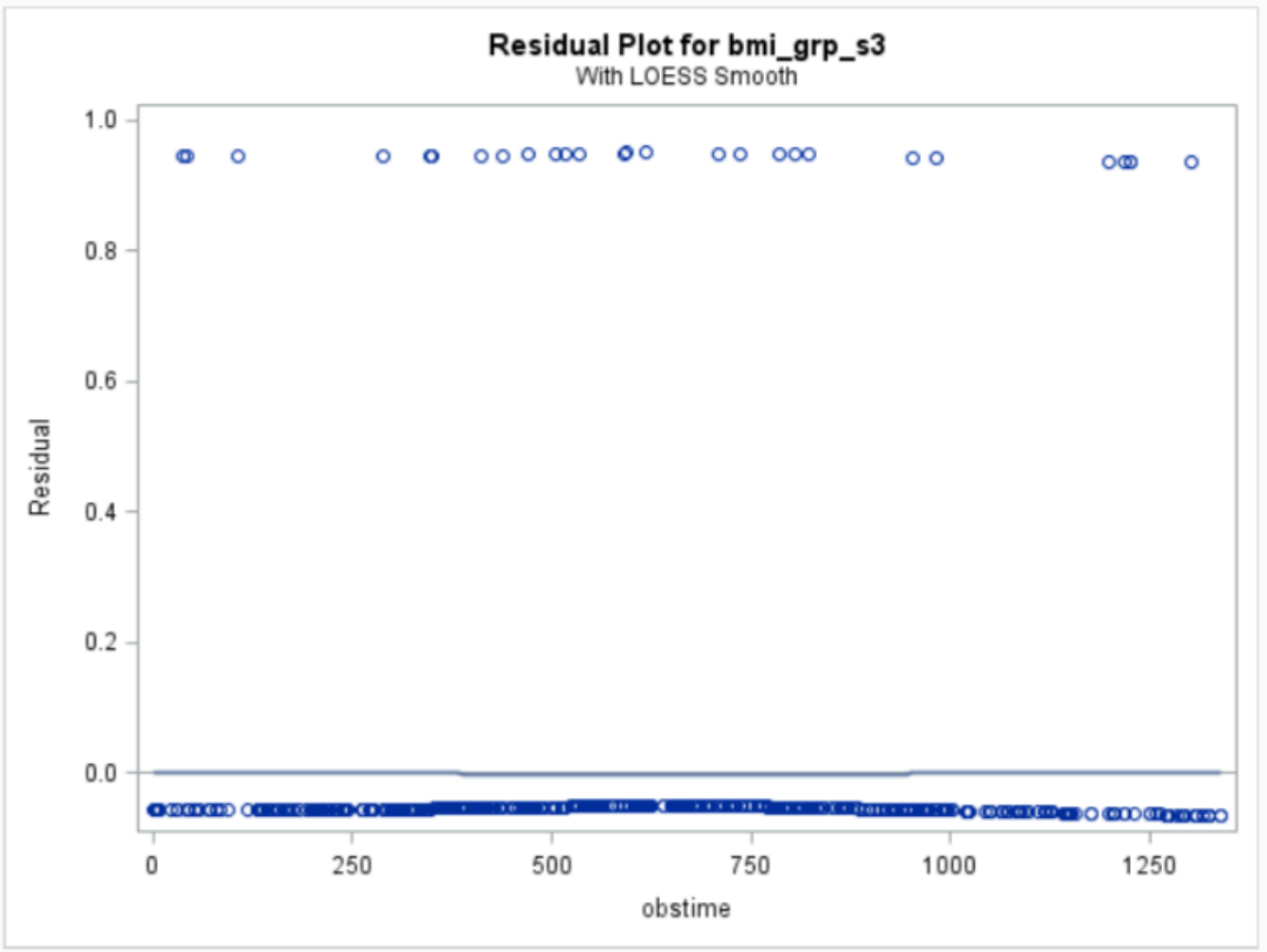

Residual Plot for alder_grp_s5
With LOESS Smooth
Residual
1.0
0.8
0.6
0.4
0.2
0.0
0
250
500
750
1000
1250
obstime

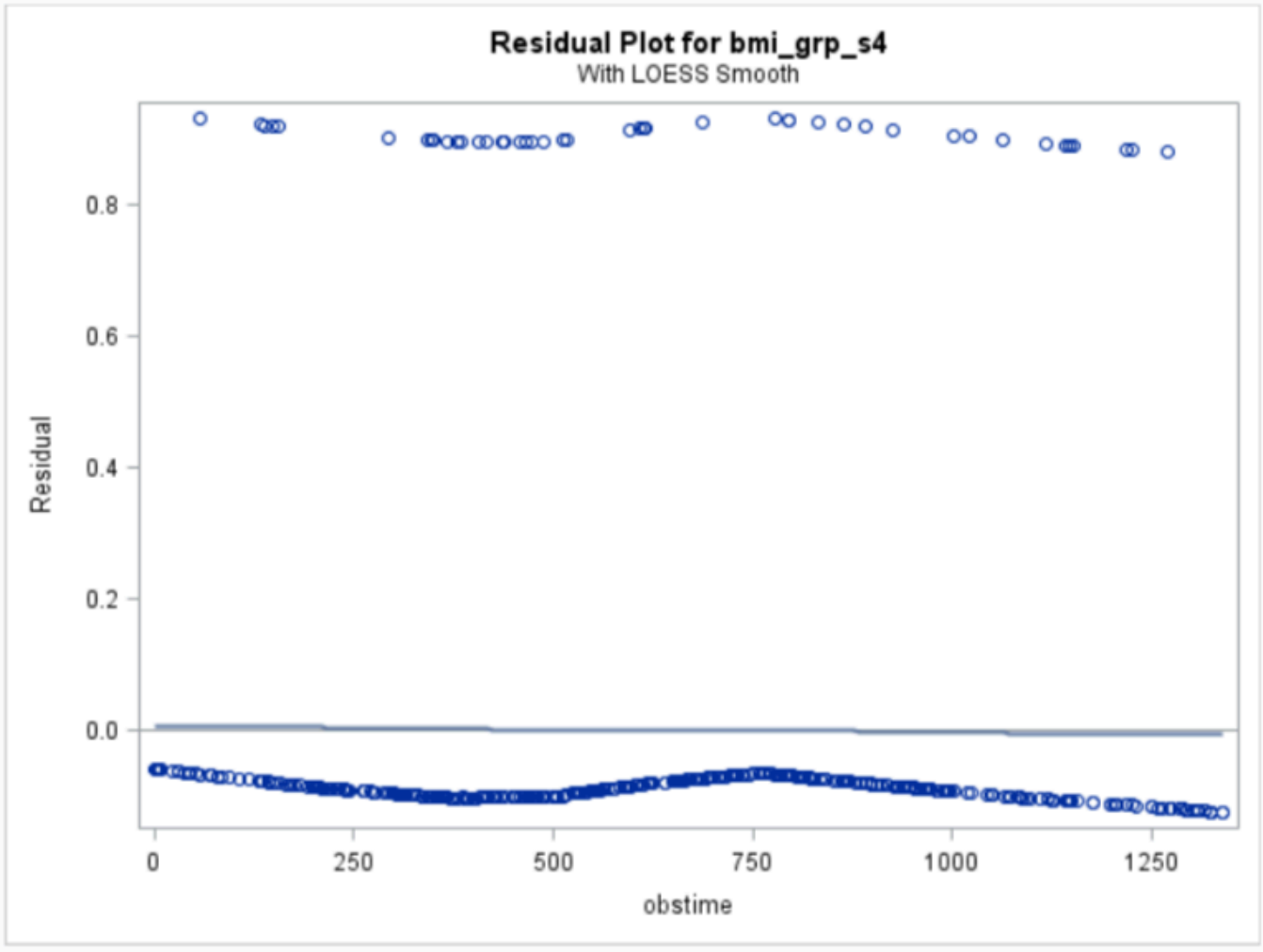
Schoenfeld residual plots of BMI

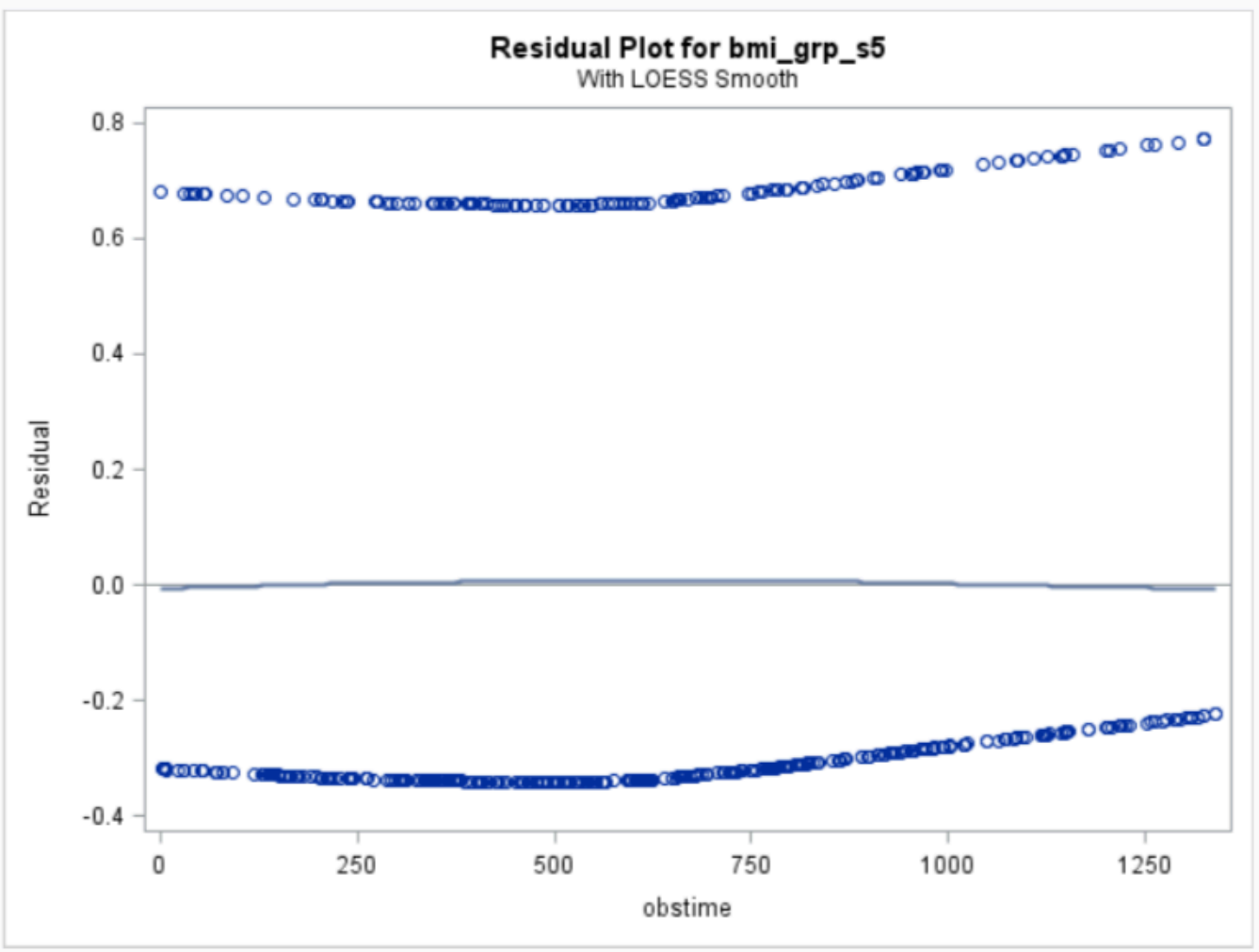



Residual Plot for bmi_grp_s1
With LOESS Smooth
Residual
0.8
0.6
0.4
0.2
0.0
-0.2
0
250
500
750
1000
1250
obstime

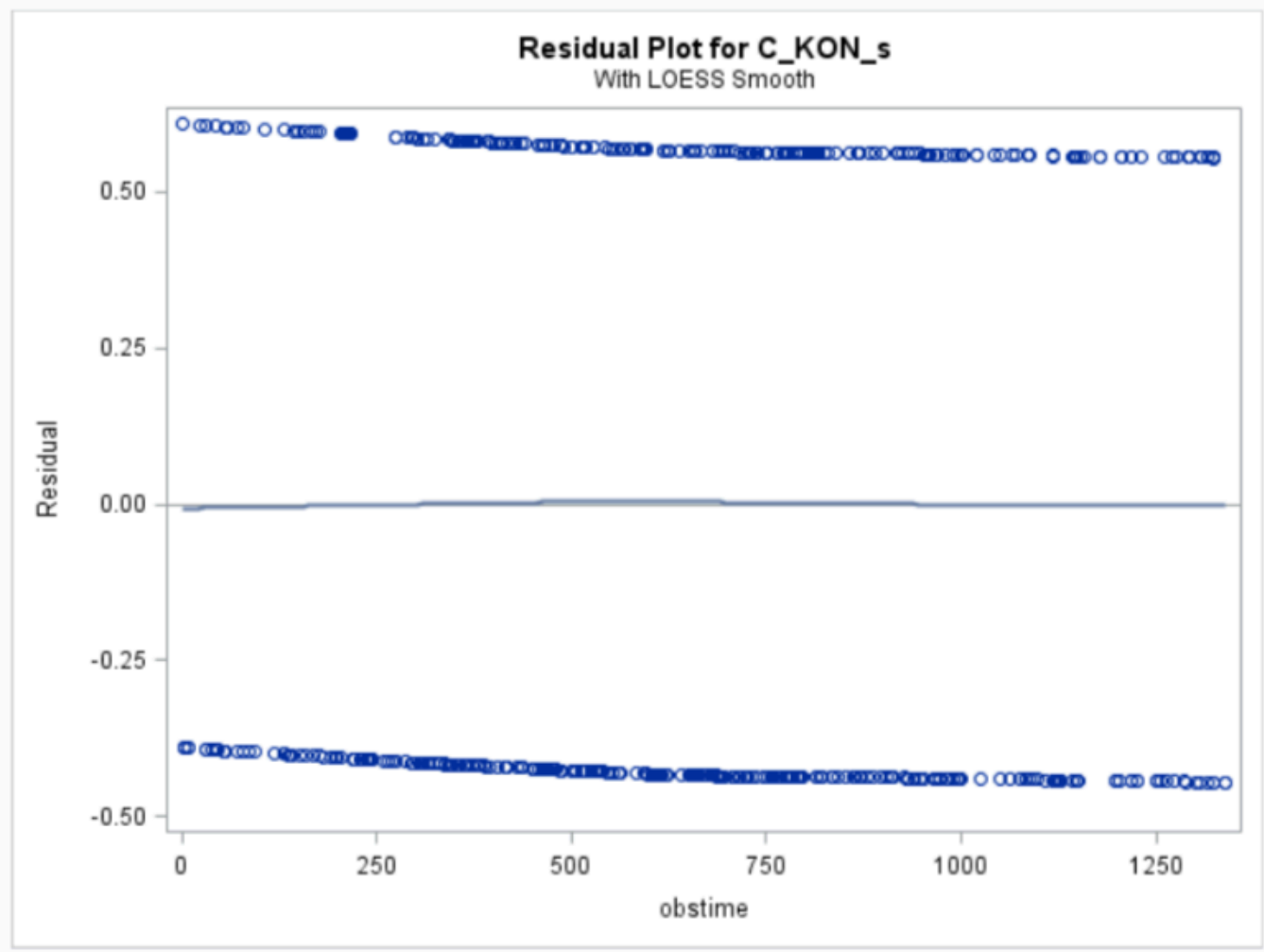

Residual Plot for bmi_grp_s2
With LOESS Smooth
Residual
0.8
0.6
0.4
0.2
0.0
0
250
500
750
1000
1250
obstime

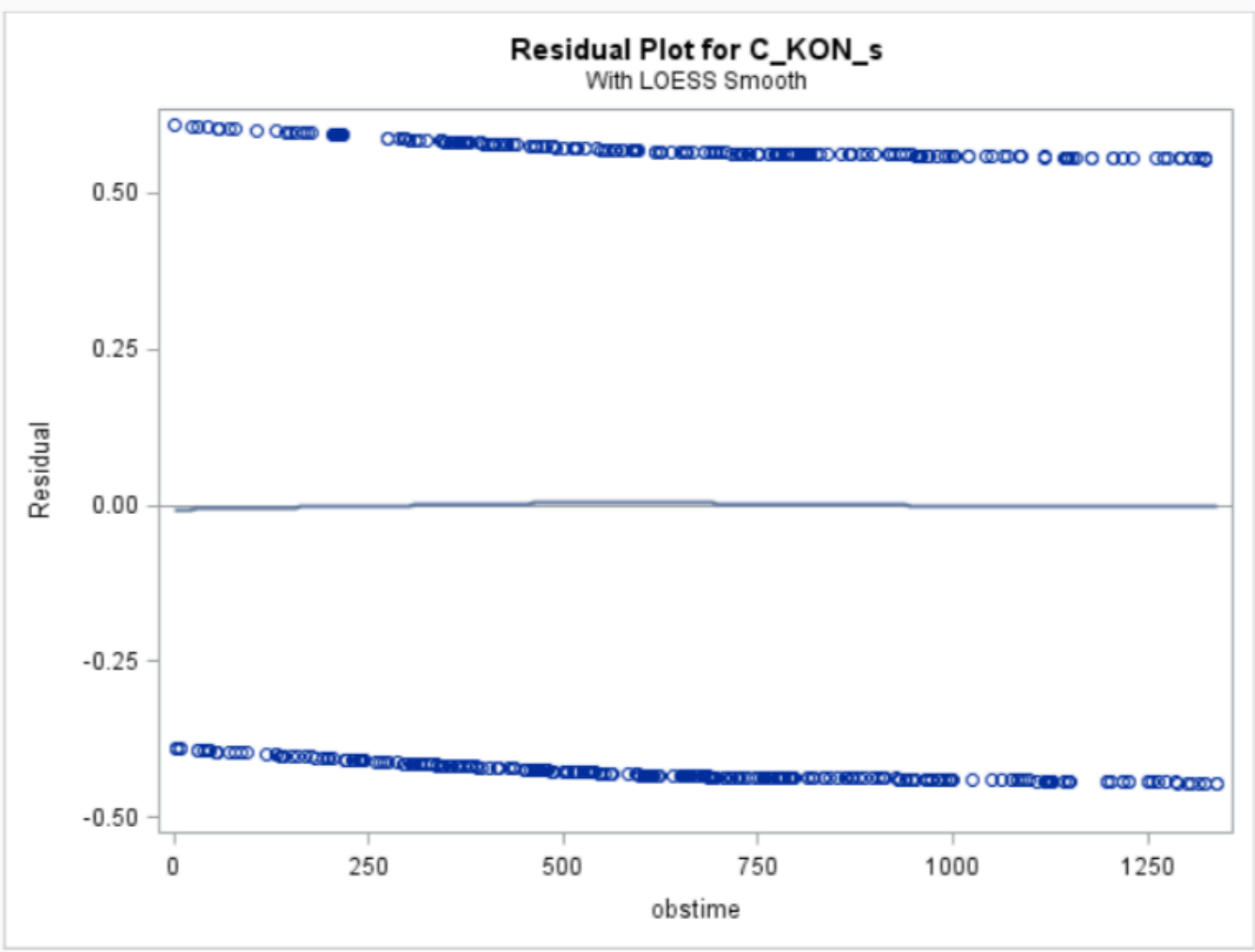

Residual Plot for bmi_grp_s3
With LOESS Smooth
Residual
1.0
0.8
0.6
0.4
0.2
0.0
0
250
500
750
1000
1250
obstime


Residual Plot for bmi_grp_s4
With LOESS Smooth
Residual
0.8
0.6
0.4
0.2
0.0
0
250
500
750
1000
1250
obstime

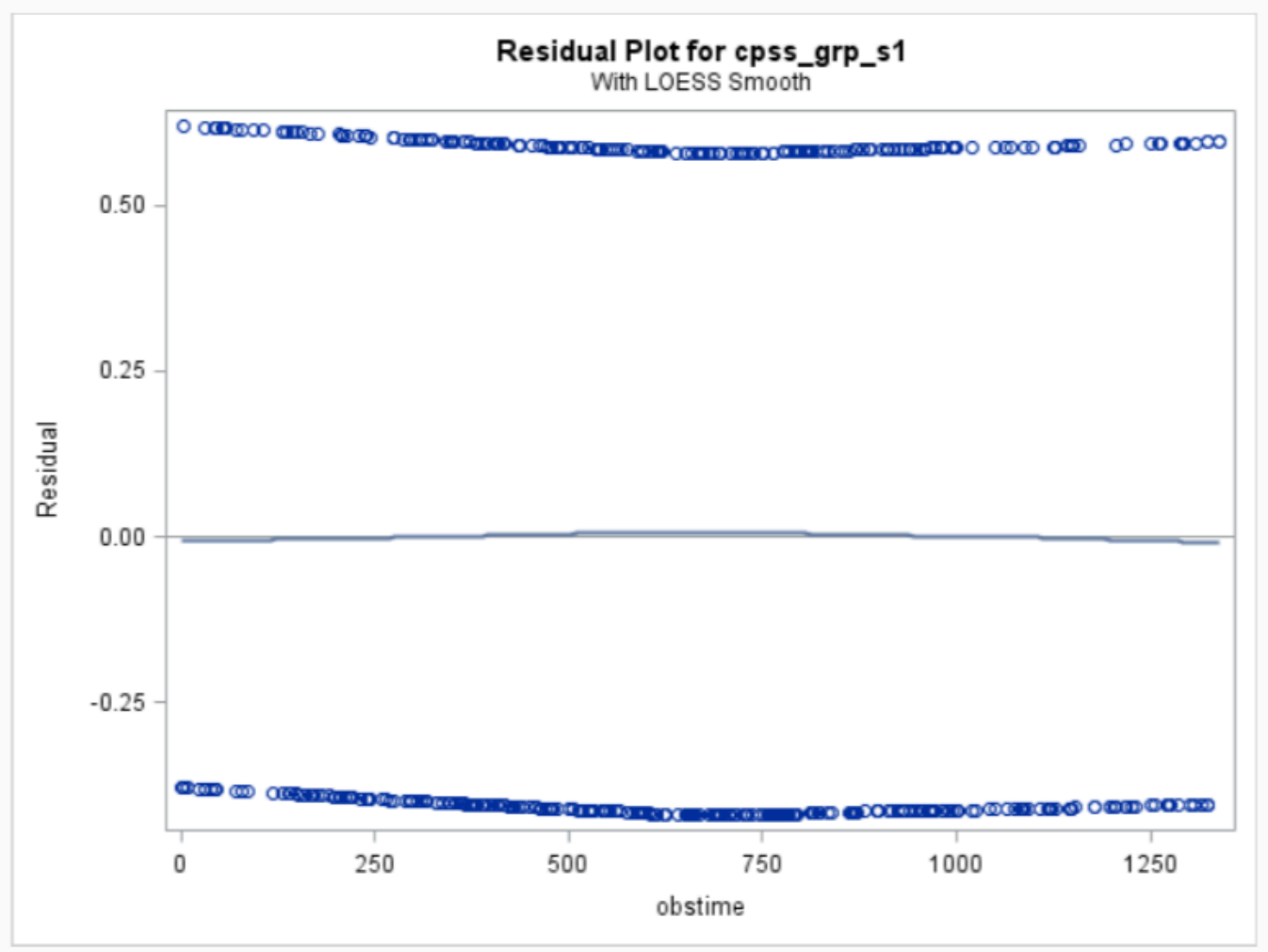

Residual Plot for bmi_grp_s5
With LOESS Smooth
Residual
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
0
250
500
750
1000
1250
obstime

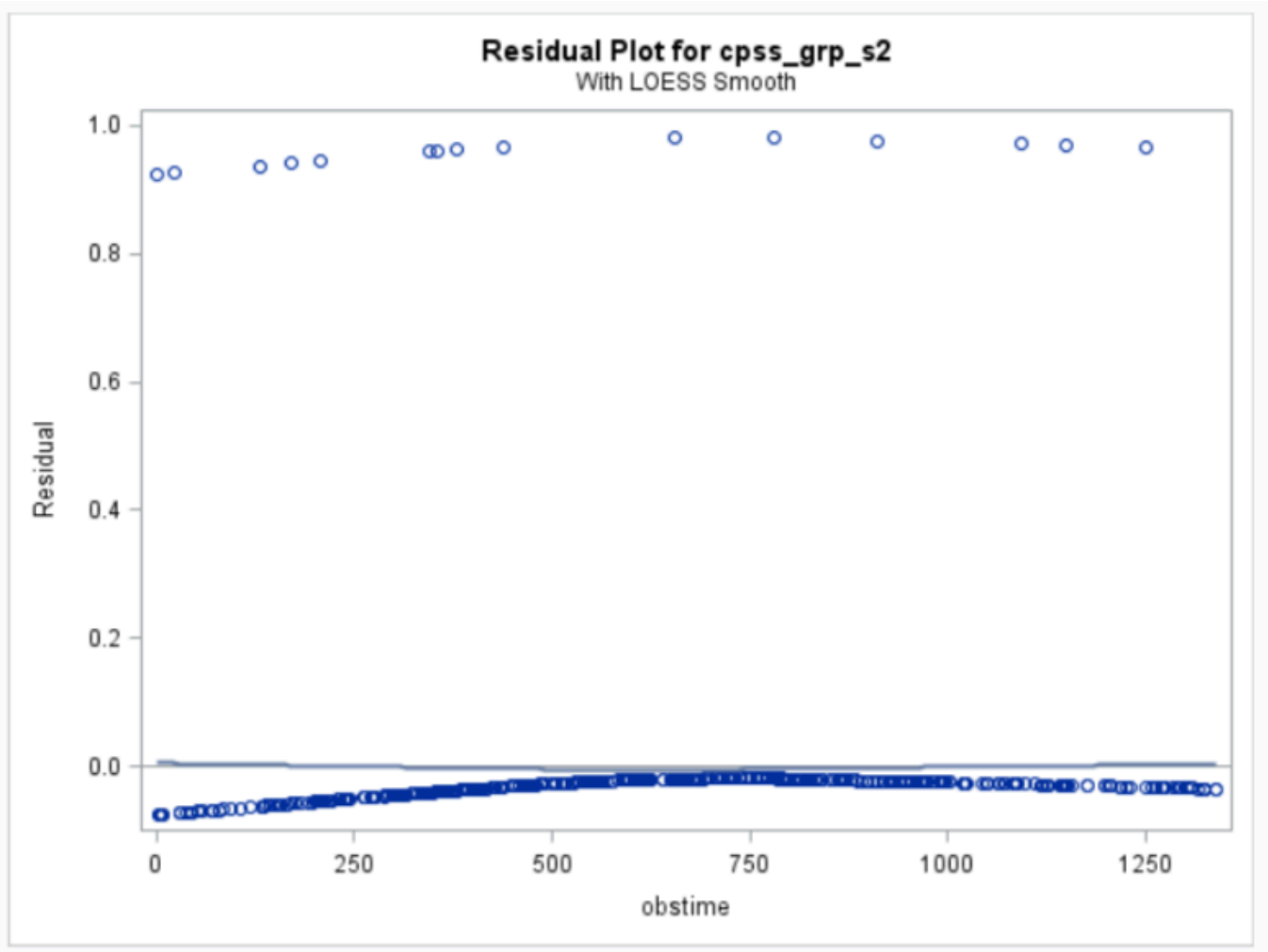
Schoenfeld residual plots of Gender



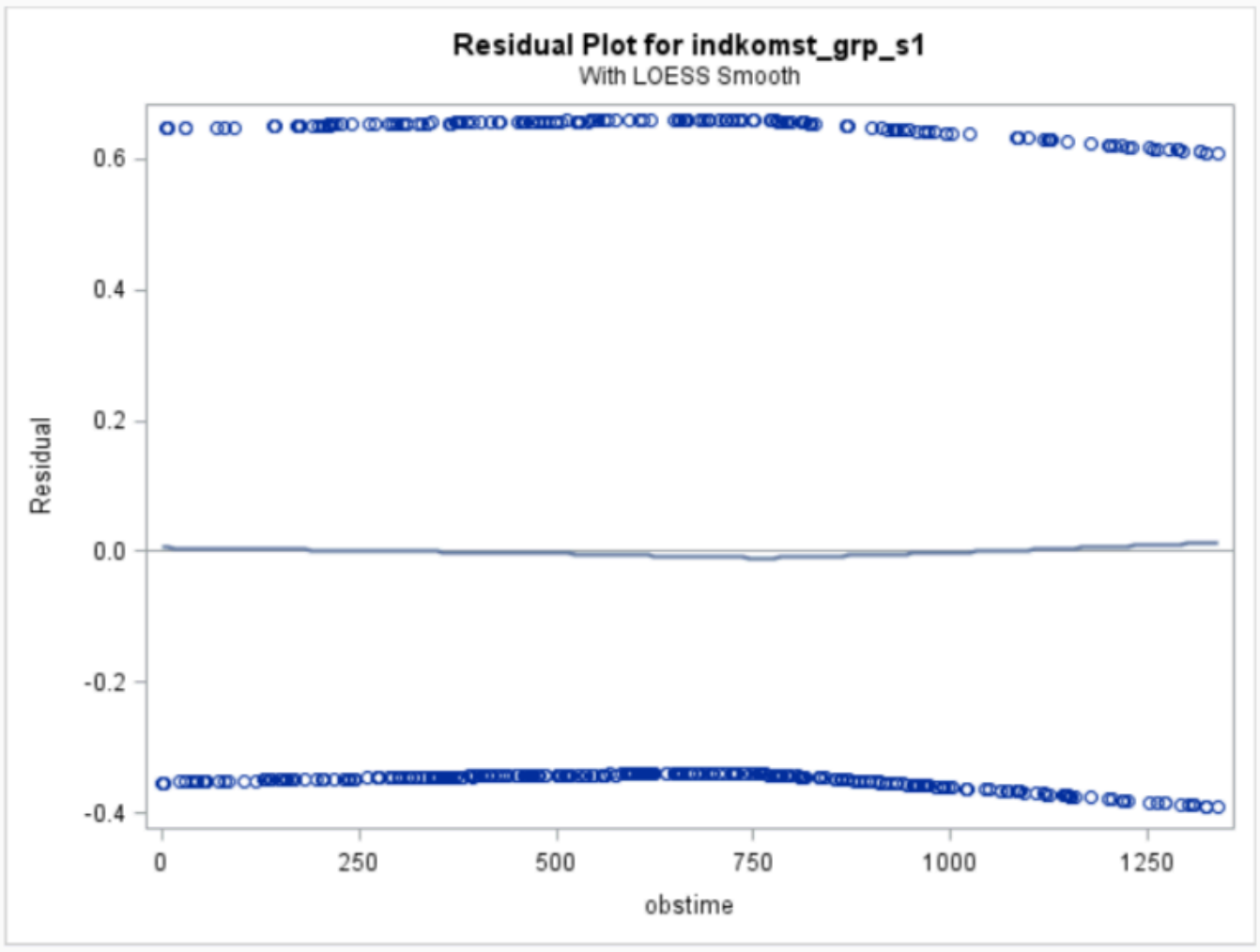

Residual Plot for C_KON_s
With LOESS Smooth
Residual
0.50
0.25
0.00
-0.25
-0.50
0
250
500
750
1000
1250
obstime

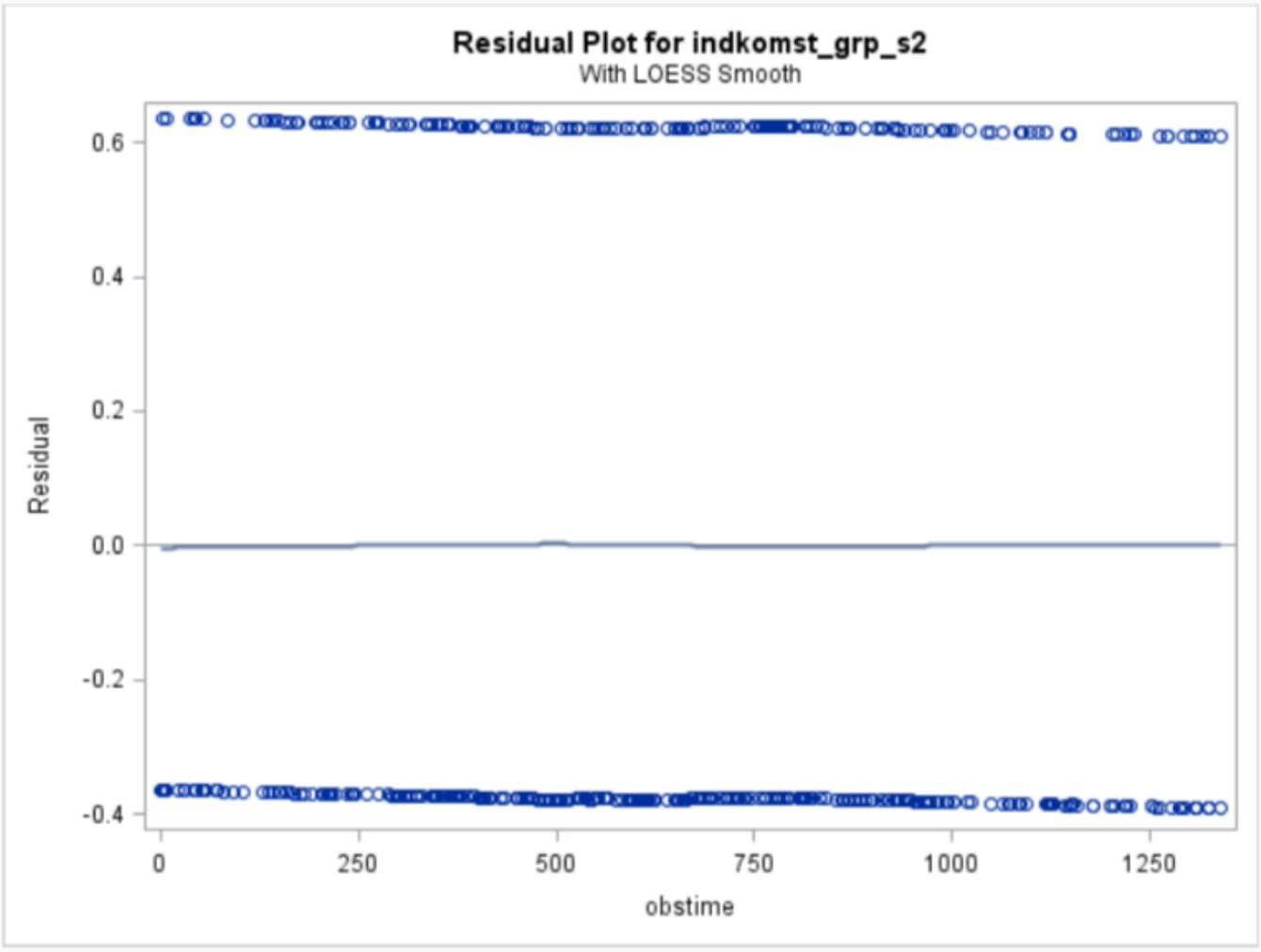
Schoenfeld residual plots of PSS-10 group

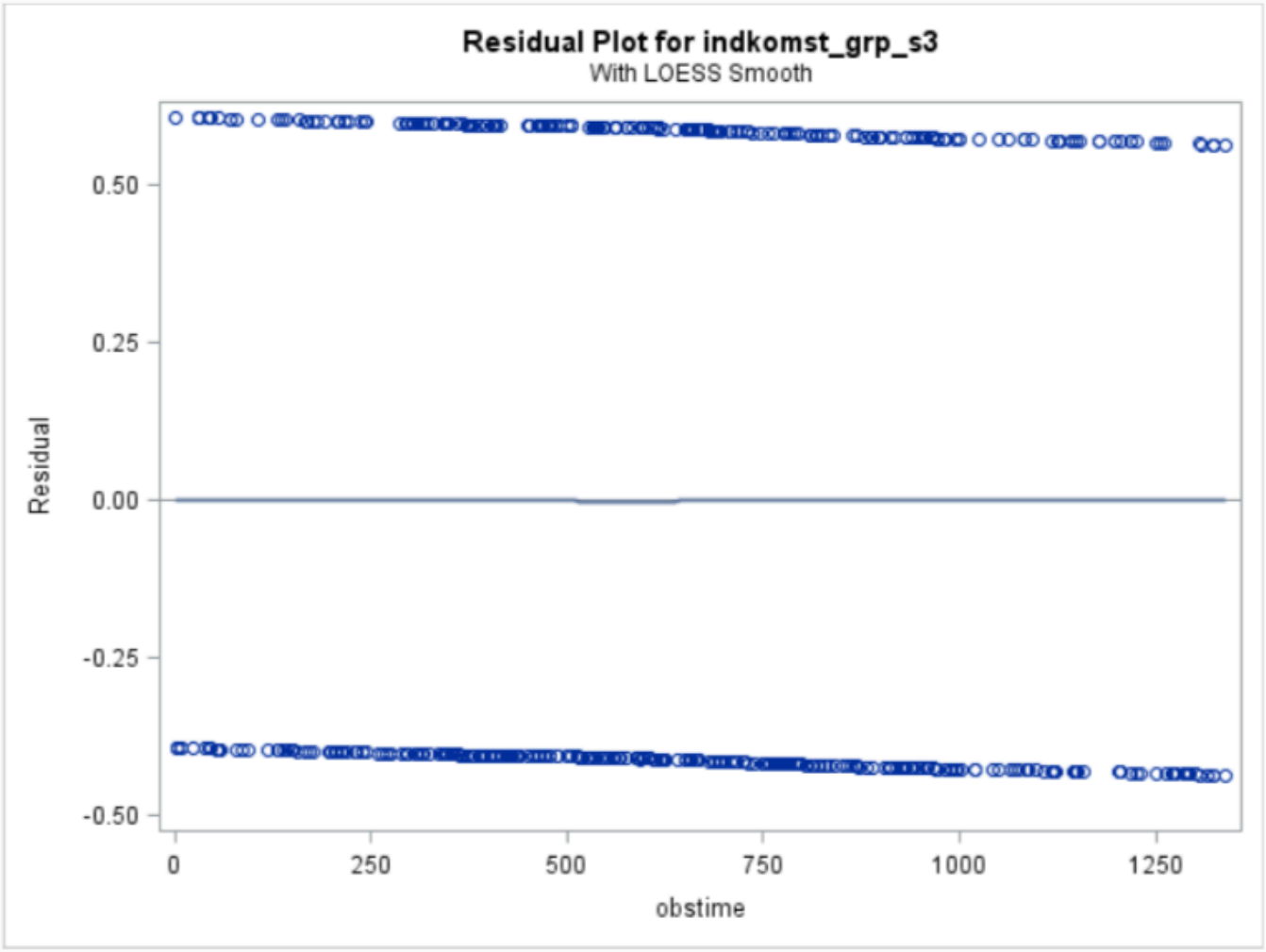


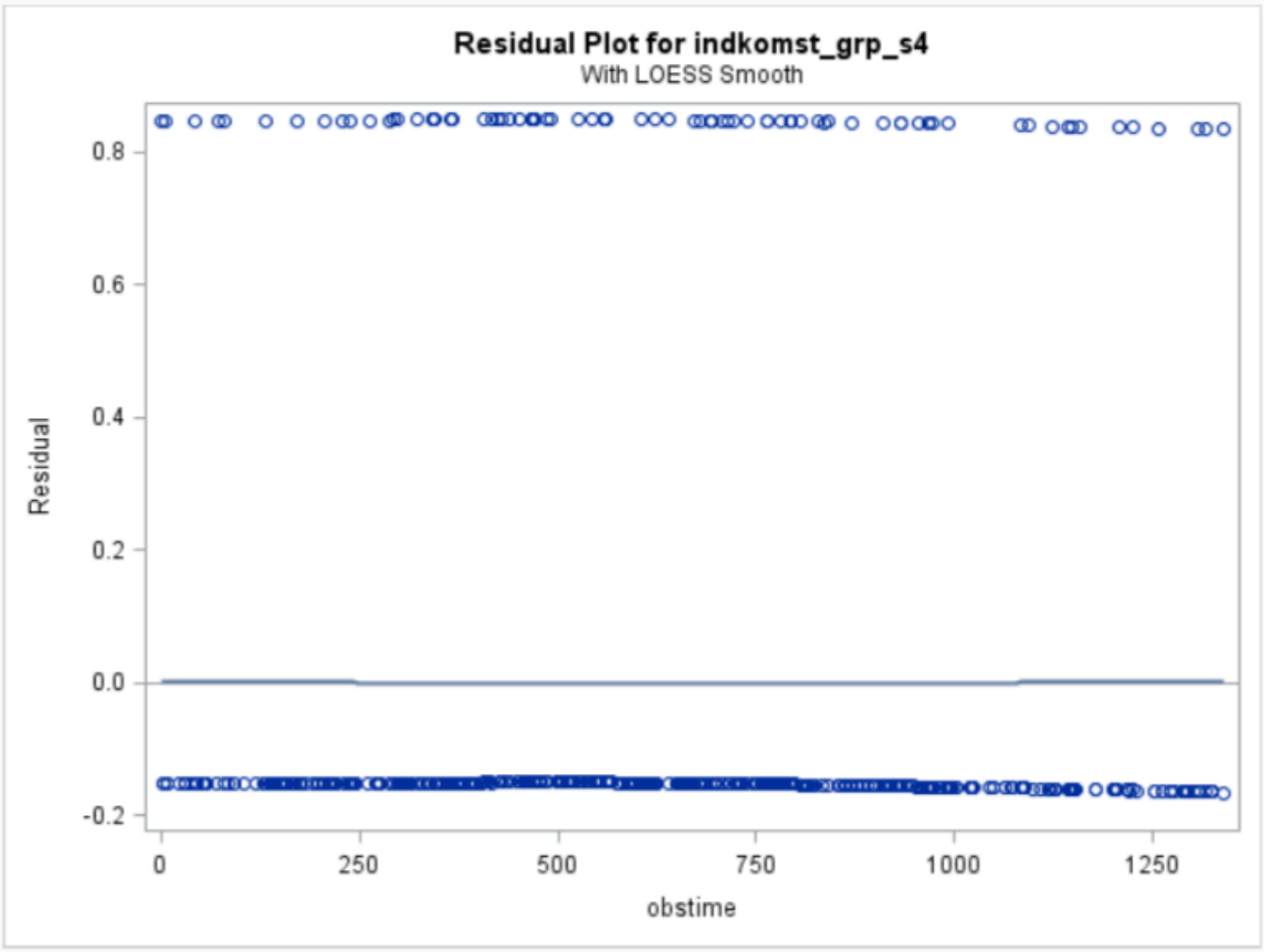

Residual Plot for cpss_grp_s2
With LOESS Smooth
Residual
1.0
0.8
0.6
0.4
0.2
0.0
0
250
500
750
1000
1250
obstime

Schoenfeld residual plots of Income

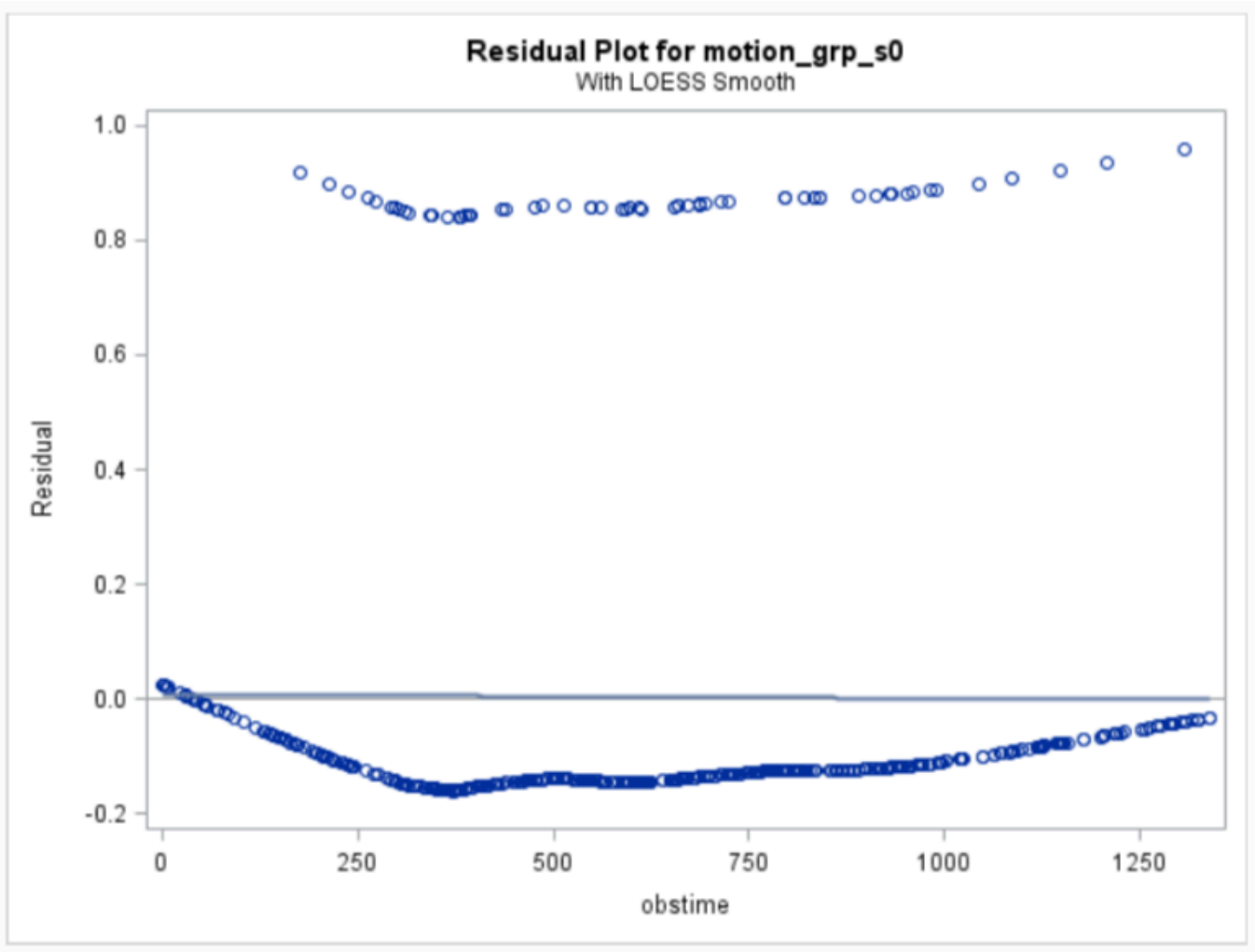


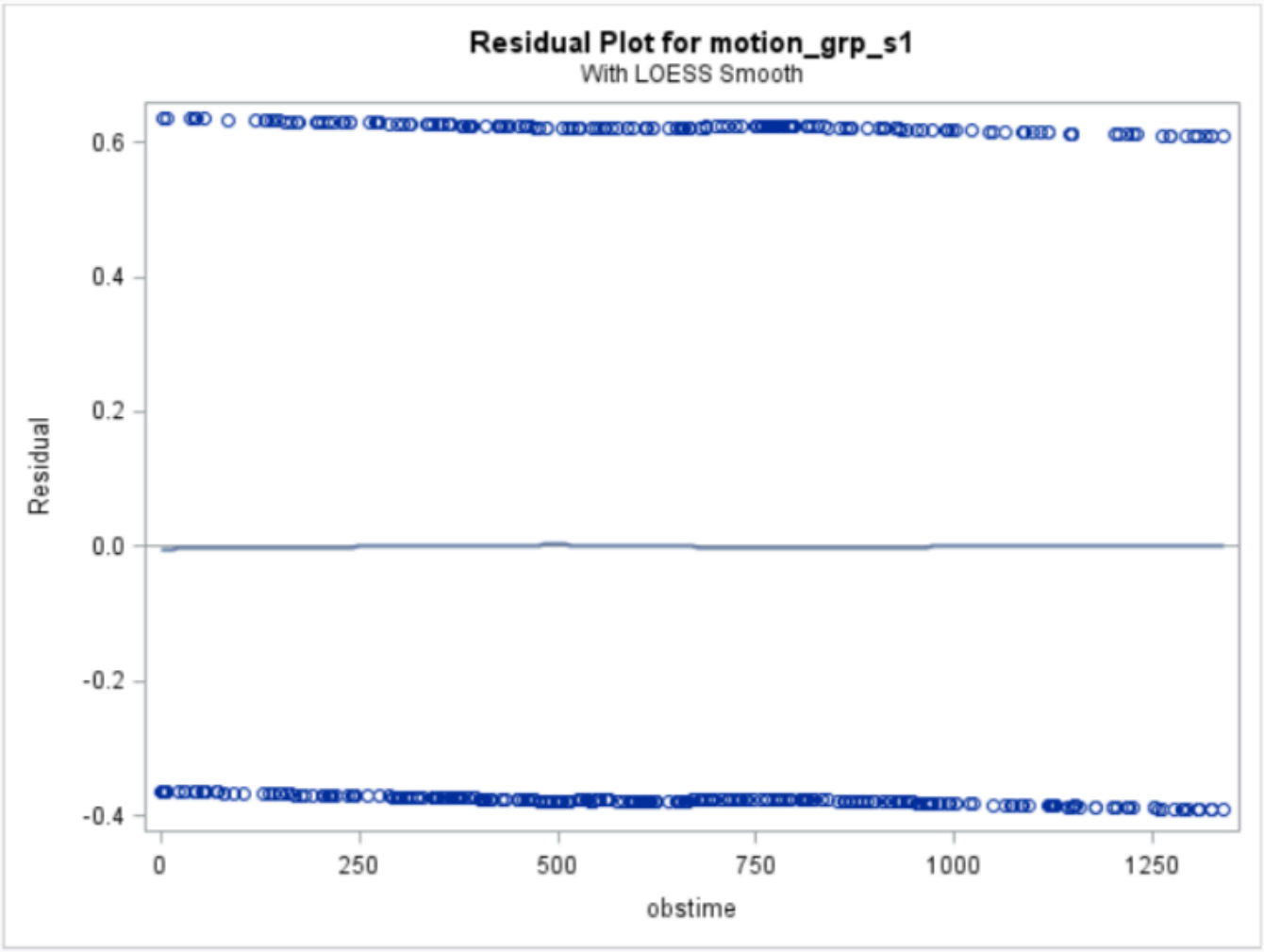

Residual Plot for indkomst_grp_s2
With LOESS Smooth
Residual
0.6
0.4
0.2
0.0
-0.2
-0.4
0
250
500
750
1000
1250
obstime


Residual Plot for indkomst_grp_s3
With LOESS Smooth
Residual
0.50
0.25
0.00
-0.25
-0.50
0
250
500
750
1000
1250
obstime

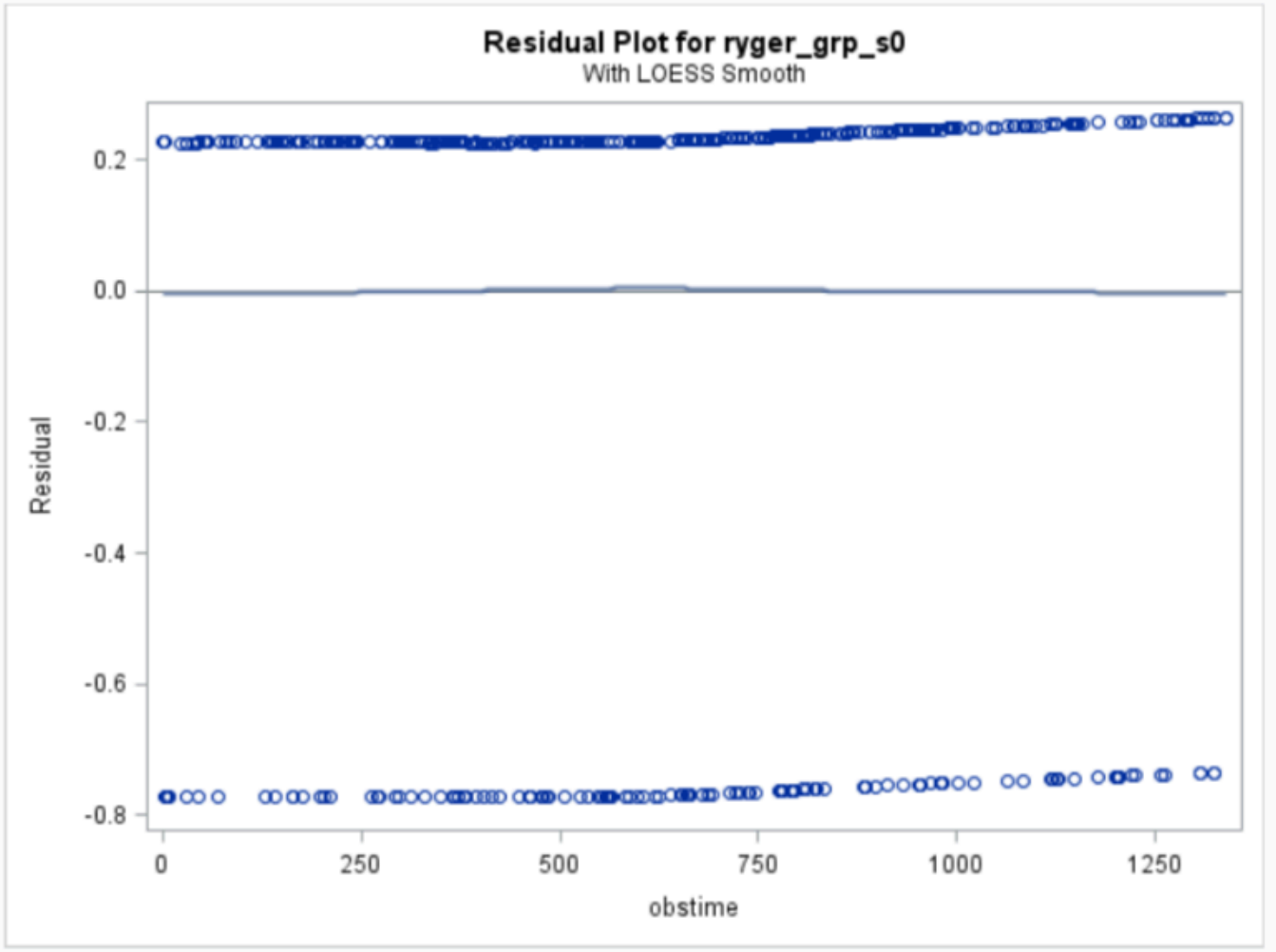

Residual Plot for indkomst_grp_s4
With LOESS Smooth
Residual
0.8
0.6
0.4
0.2
0.0
-0.2
0
250
500
750
1000
1250
obstime

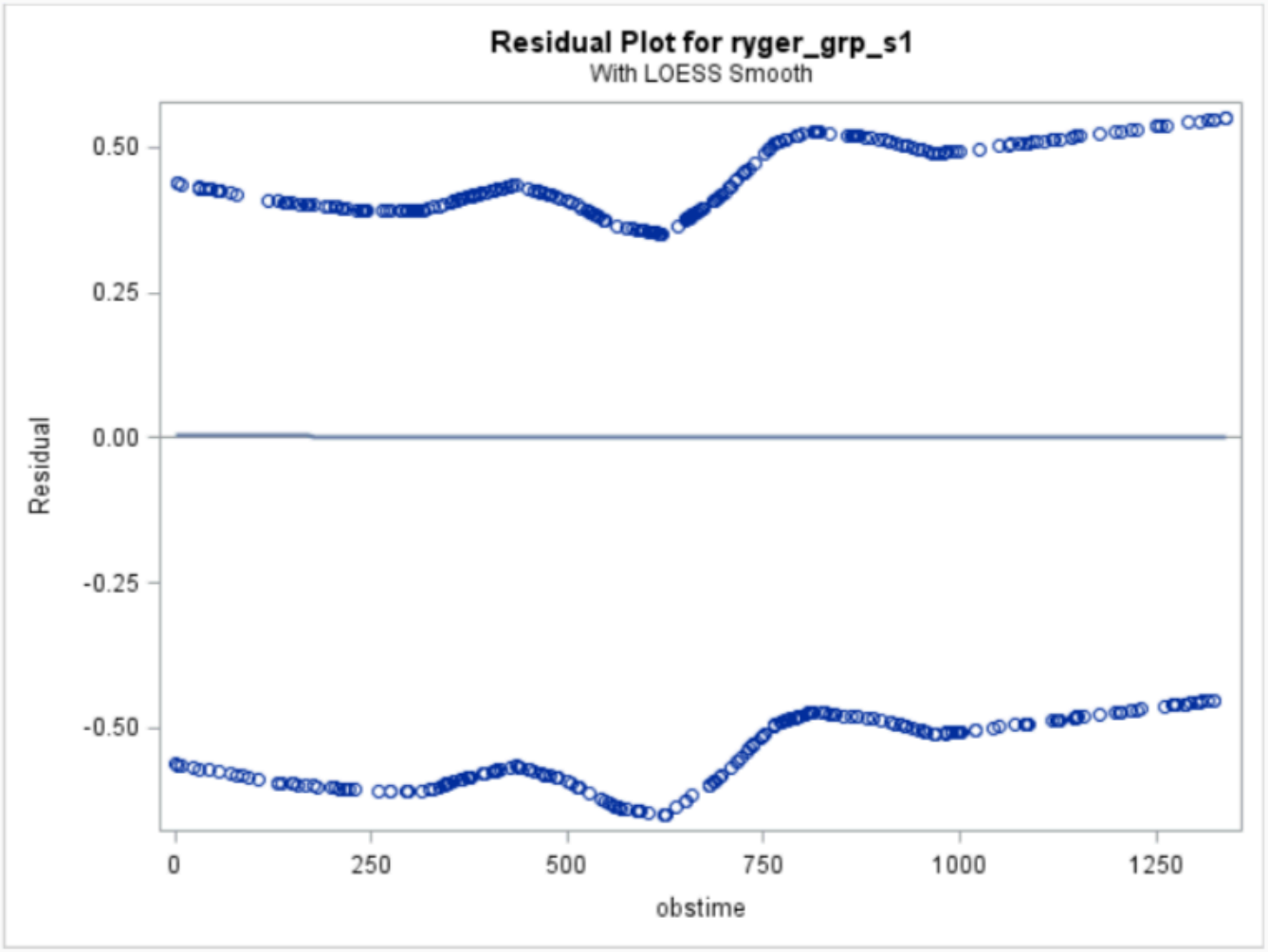
Schoenfeld residual plots of Physical activity

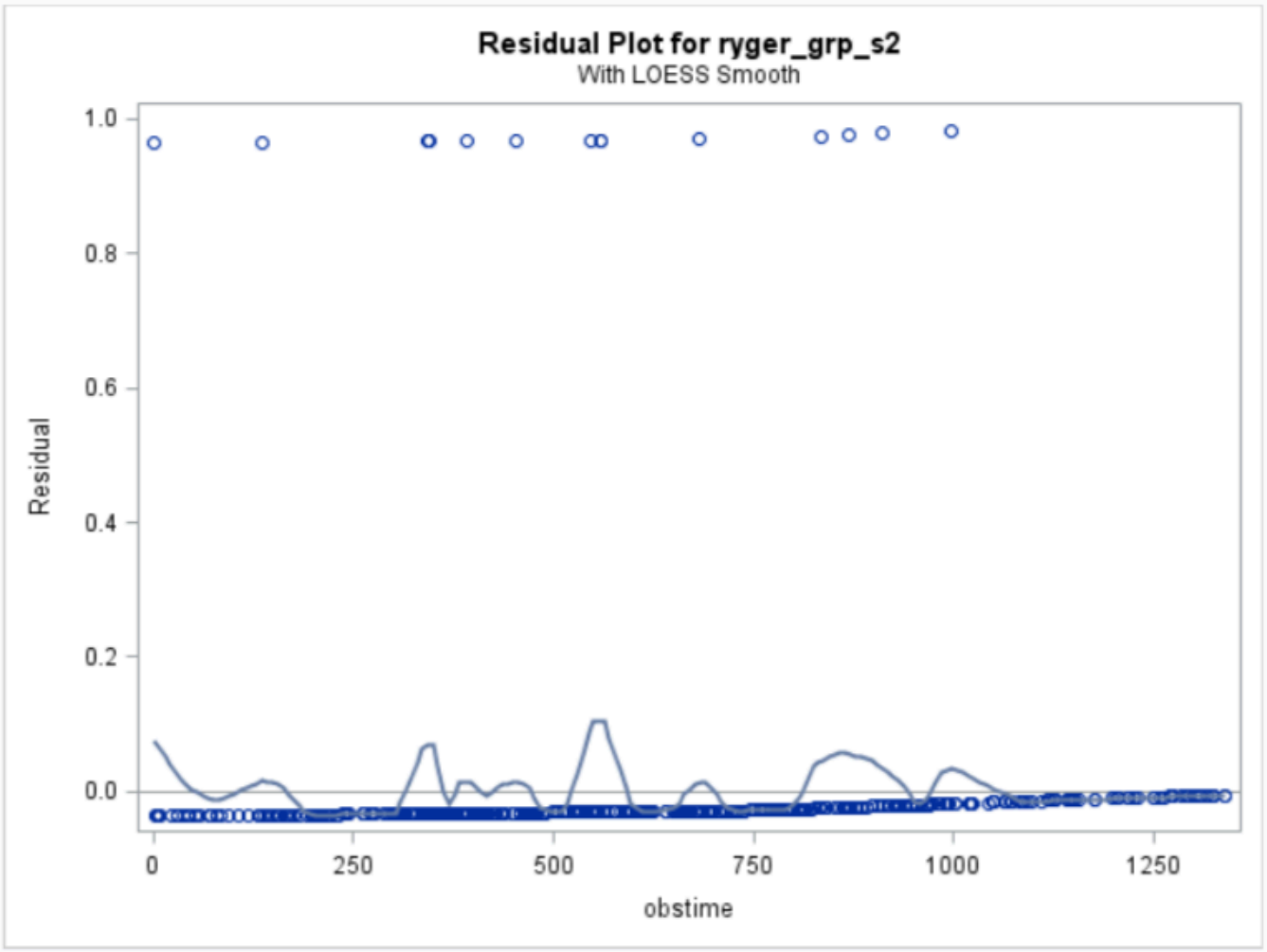


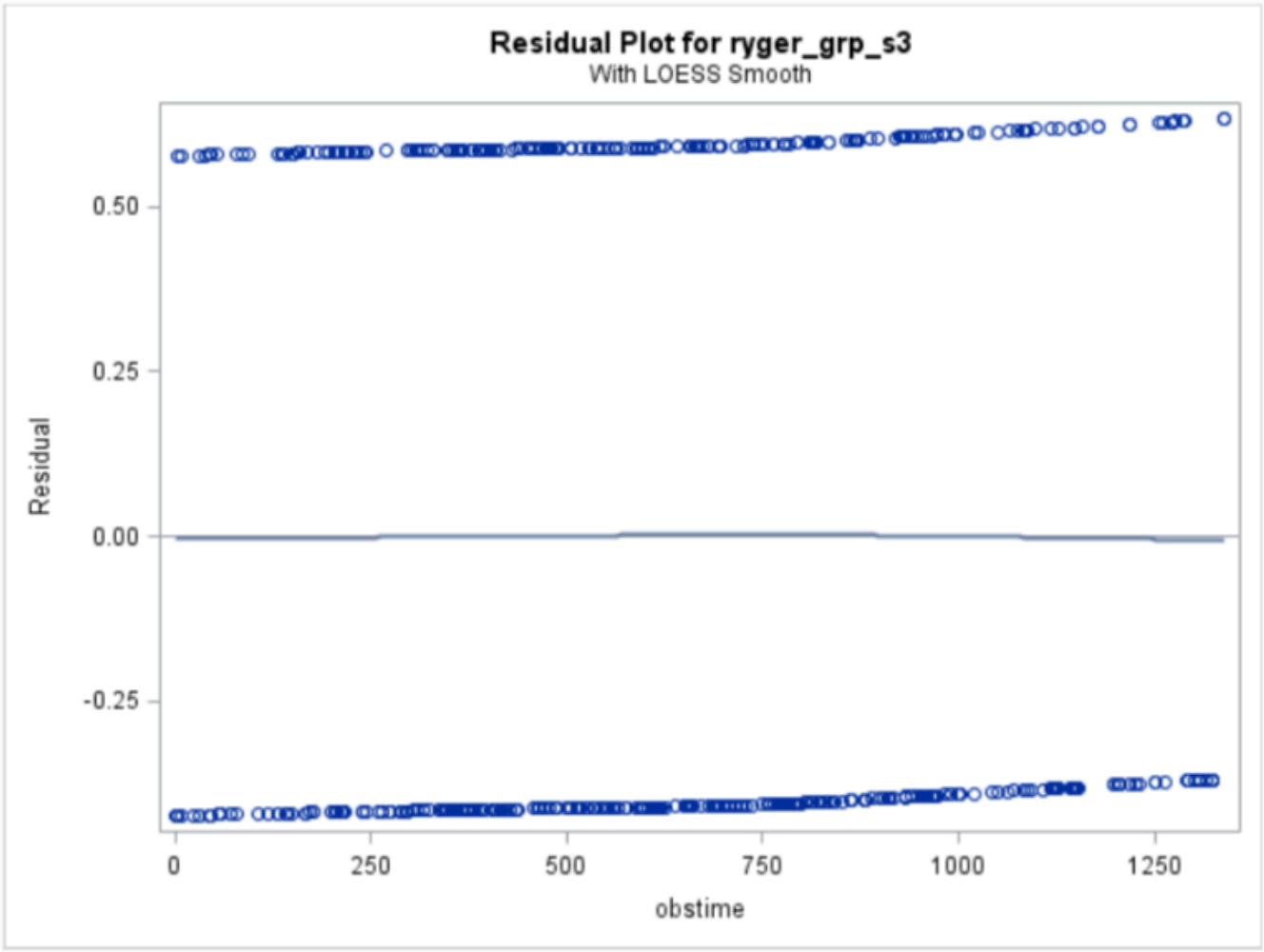

Residual Plot for motion_grp_s1
With LOESS Smooth
Residual
0.6
0.4
0.2
0.0
-0.2
-0.4
0
250
500
750
1000
1250
obstime

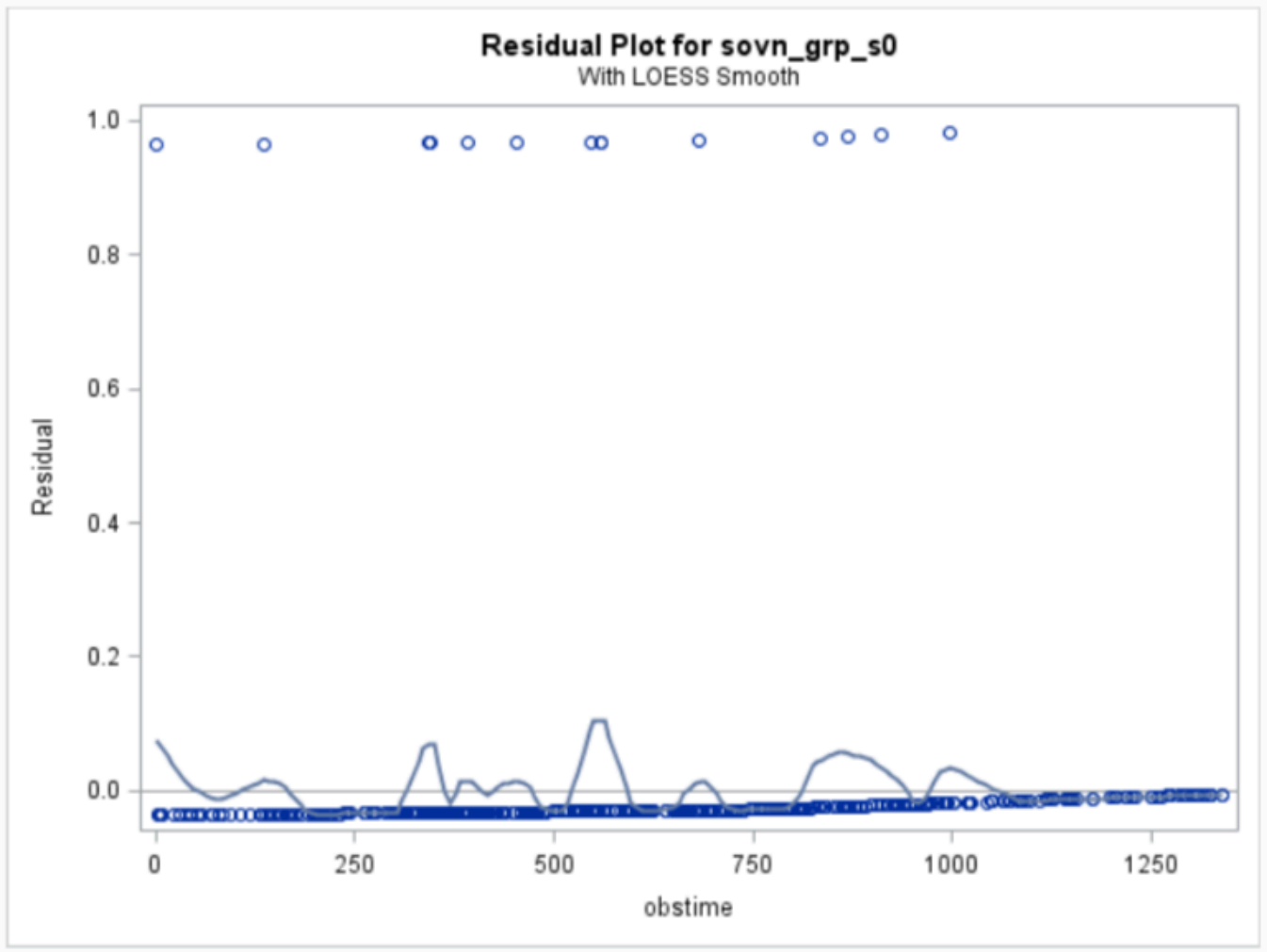
Schoenfeld residual plots of Smoking Status



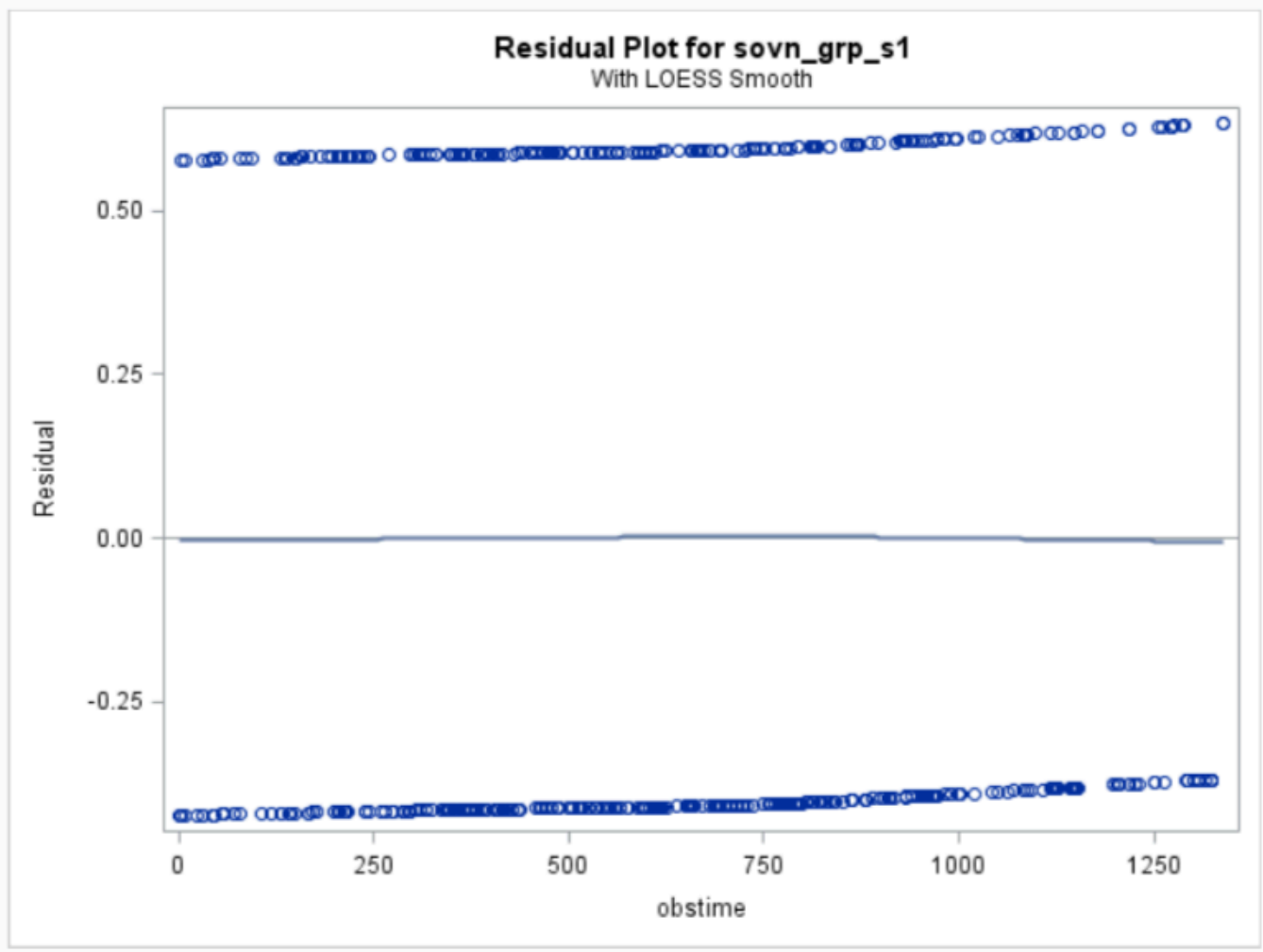

Residual Plot for ryger_grp_s1
With LOESS Smooth
Residual
0.50
0.25
0.00
-0.25
-0.50
0
250
500
750
1000
1250
obstime

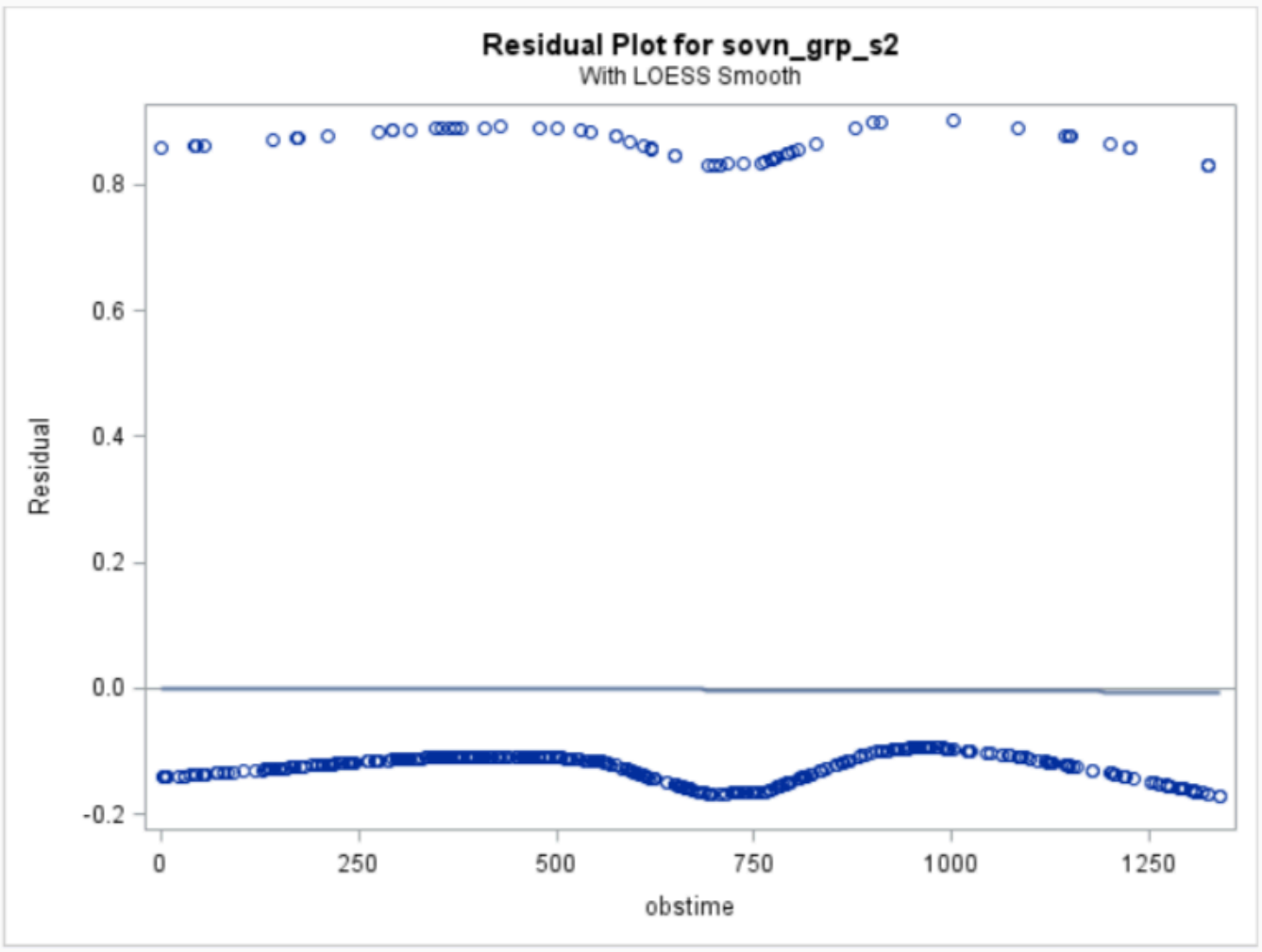

Residual Plot for ryger_grp_s2
With LOESS Smooth
Residual
1.0
0.8
0.6
0.4
0.2
0.0
0
250
500
750
1000
1250
obstime


Residual Plot for ryger_grp_s3
With LOESS Smooth
Residual
0.50
0.25
0.00
-0.25
0
250
500
750
1000
1250
obstime

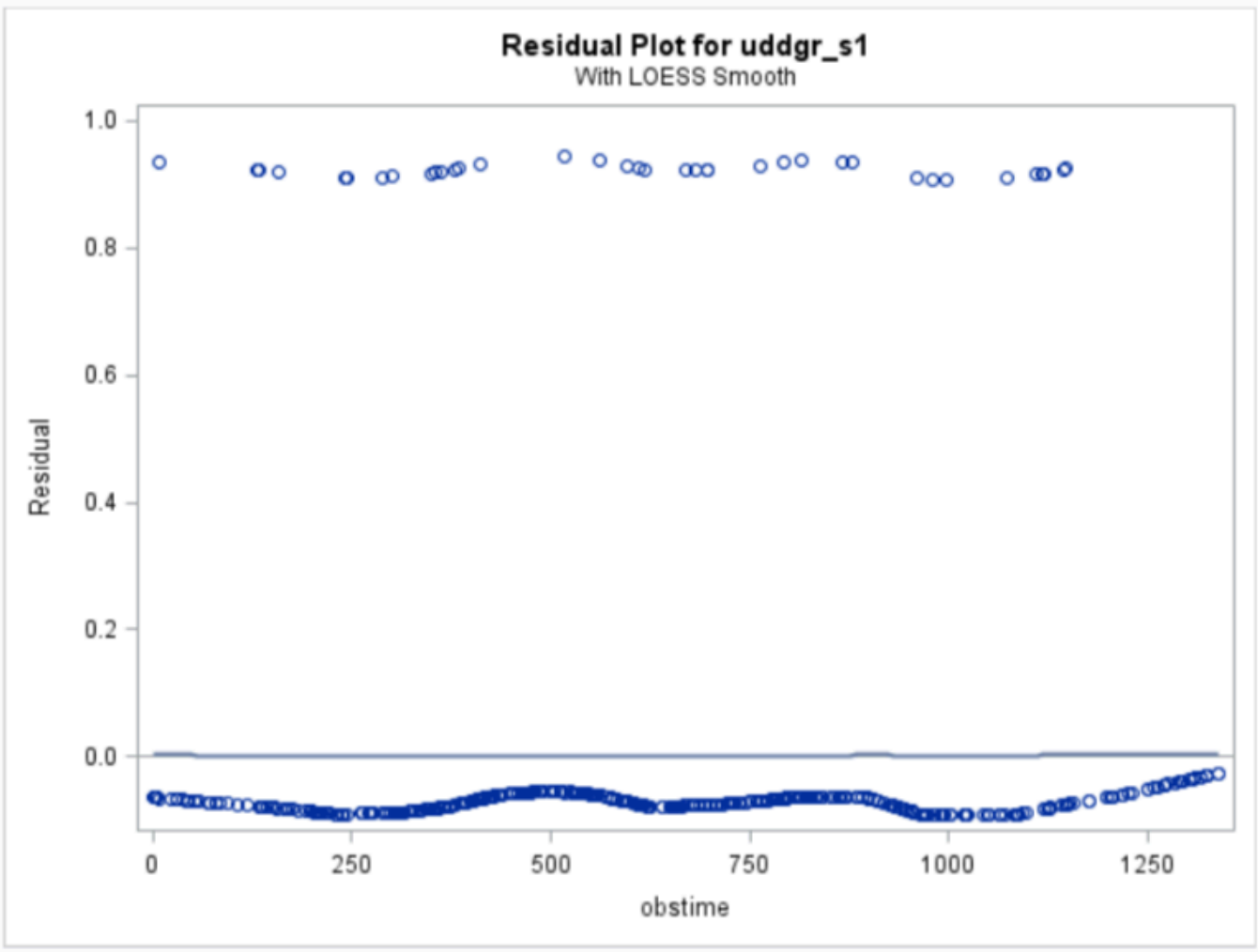

Residual Plot for sovn_grp_s0
With LOESS Smooth
Residual
1.0
0.8
0.6
0.4
0.2
0.0
0
250
500
750
1000
1250
obstime

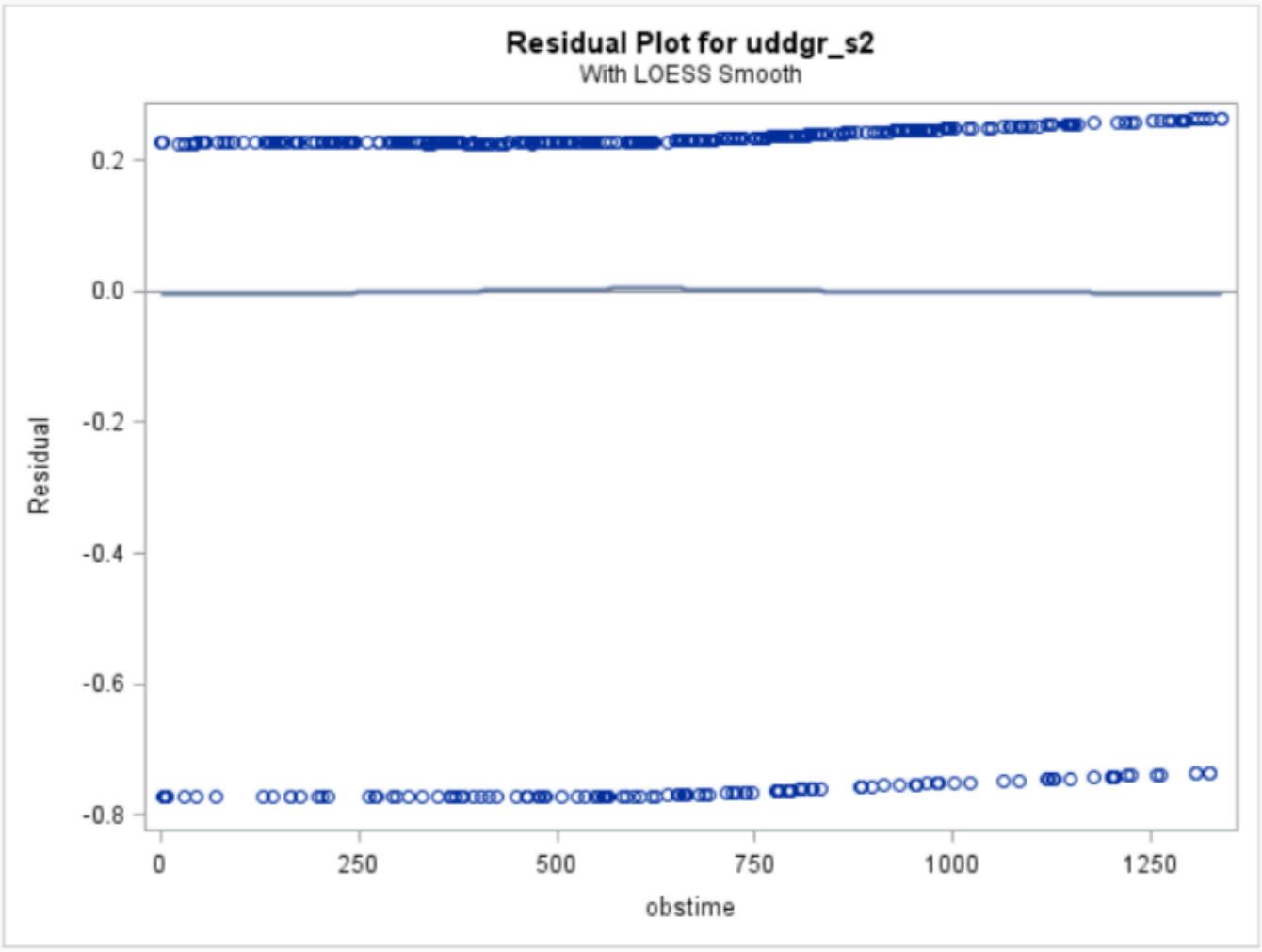
Schoenfeld residual plots of Sleep

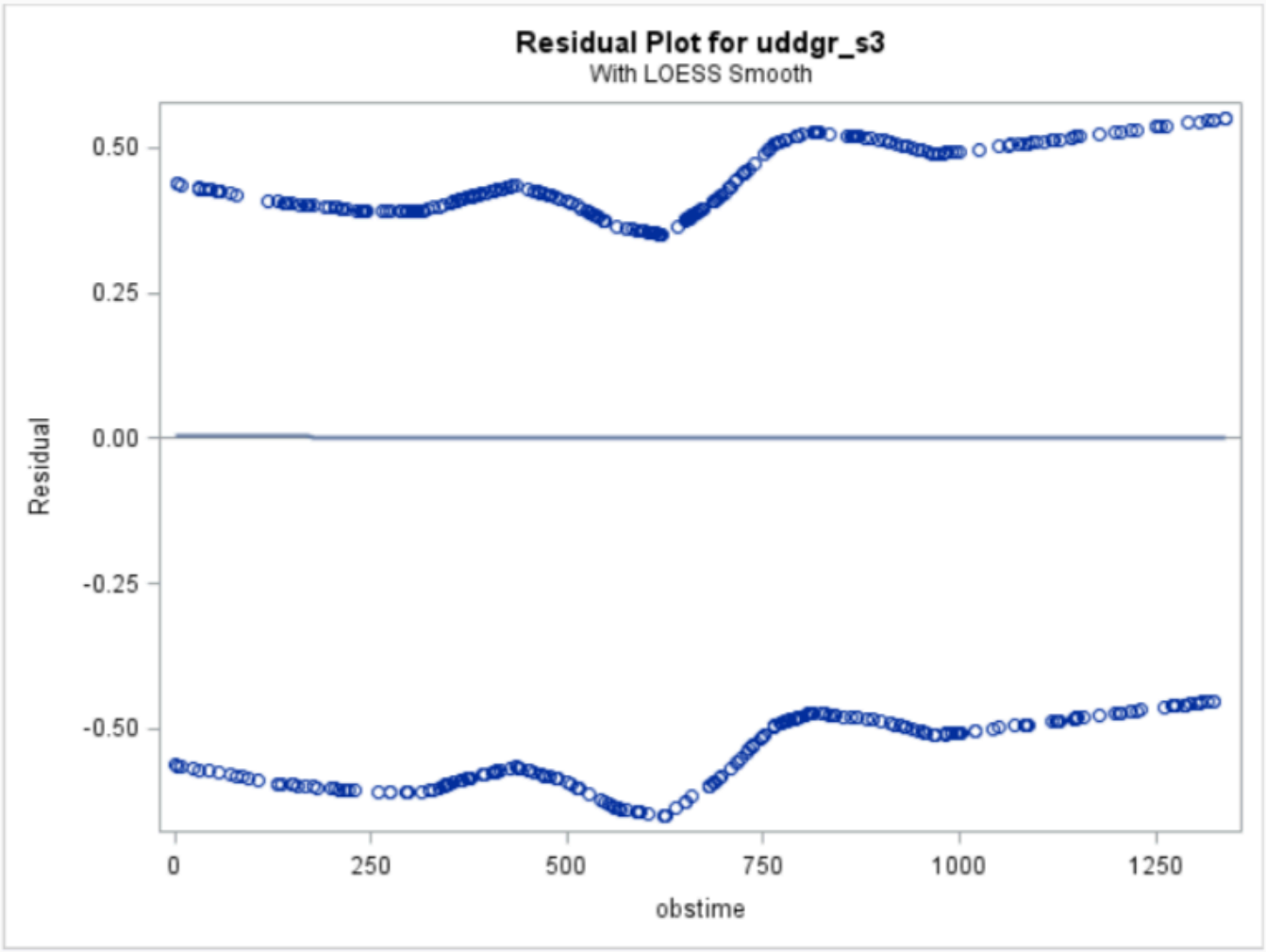



Residual Plot for sovn_grp_s2
With LOESS Smooth
Residual
0.8
0.6
0.4
0.2
0.0
-0.2
0
250
500
750
1000
1250
obstime

Schoenfeld residual plots of Education




Residual Plot for uddgr_s2
With LOESS Smooth
Residual
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0
250
500
750
1000
1250
obstime


Residual Plot for uddgr_s3
With LOESS Smooth
Residual
0.50
0.25
0.00
-0.25
-0.50
0
250
500
750
1000
1250
obstime