**Supplementary Material S1: Description of outcome, exposure and covariate assessment**

*Outcome*

Body height was measured with a calibrated stadiometer (Seca 225/213 stadiometer, Birmingham, UK) to the nearest 0.1 cm. Weight was assessed on a calibrated Tanita scale (Tanita Europe GmbH, Sindelfingen, Germany) accurate to 0.1 kg in a fasting state with children wearing light underwear. In W3, body height and weight were self-reported by the study participants. Weight (kg) divided by height (m) squared was calculated to determine the Body Mass Index (BMI). BMI was categorized according to the extended IOTF criteria for study subjects <18 years [1] and according to WHO for subjects ≥18 years [2].

*Exposures and covariates*

Unless otherwise stated, exposure/covariate information was obtained from parentally reported questionnaires or self-reported questionnaires (in children/teens ≥ 12 years) completed at the W0, W1, W2 and W3 surveys. Questions on pregnancy-related variables were posed to biological mothers only. Several variables were dichotomized in order to reduce model complexity considering the large number of included variables.

Non-modifiable factors

Age (in years) at baseline, sex (female; ref male), region of residence (North/Central Europe including Belgium, Sweden and Germany, Southern Europe including Cyprus, Italy, Spain and Eastern Europe including Estonia and Hungary), family history of obesity (diagnosed obesity in at least one parent, grandparent or sibling; yes vs no), study region (control vs intervention region) and migrant status (at least one parent born in foreign country vs both parents born in the country of residence) were considered as non-modifiable covariates in the analyses.

Educational level of parents

Highest educational level of parents at baseline was categorized according to the International Standard Classification of Education (ISCED).[3] The maximum ISCED level of both parents was categorized into three categories (low=ISCED levels 0,1,2, medium= ISCD levels 3,4,5 vs high=ISCED levels 6,7,8).

Early life factors

For early life factors, information was assessed in W0 via questionnaires and updated by W1 values in case of missing W0 data.

*Maternal body mass index (BMI; kg/m2):* Maternal BMI at W0, W1 and W2 was calculated as weight (kg) divided by height (m) squared where weight/height were self-reported in W0 and W1 and measured in W2. In W3 no information on maternal BMI is available.

*Smoking of mother during pregnancy:* For smoking frequency answer categories ranged from ‘Never’, ‘Rarely, at max once a month’, ‘Several occasions a week’ to ‘Daily’. To improve stability of model

estimates, the original smoking categories were dichotomized into ‘Never’ vs. ‘Rarely/at least several occasions a week/daily’.

*Weight gain during pregnancy (kg):* Information was obtained from biological mothers via questionnaires.

*Gestational age of new-born at delivery:* A binary indicator was constructed for children delivered at term vs. children born pre-term (≤ 37th gestational week; yes vs no), information was obtained from biological mothers via questionnaires.

*Birth weight (g)* of the child and mother’s age at birth (years) was reported by mothers.

*Total breastfeeding duration:* Starting and ending months of exclusive breastfeeding and breastfeeding combinations with solid foods and/or formula milk were used to derive the total breastfeeding duration.

Well-being

*Well-being score:* Psychosocial well-being was measured with 16 items of four subscales of the “KINDL-R Questionnaire for Measuring Health-Related Quality of Life (HRQoL) in Children and Adolescents” (emotional well-being, self-esteem, family life and relations to friends).[4, 5] At W2, response categories corresponded to the original 5-point Likert scale (never, seldom, sometimes, often, all the time). At W0 and W1 the two highest response categories were combined into one category. Therefore, we deviated from the original scoring (1-5 points per item) and assigned 0 points for “Never” and 3 points for both “Often” and “All the time” (at follow-up) or “Often/All the time” (at baseline), respectively (six negatively worded items were coded reversely). Consequently, the score ranged from 0-48 with a higher score indicating a higher well-being. As the instruments changed in W3 in study participants ≥ 18 years, the well-being score was only calculated for waves W0 to W2.

Lifestyle exposures

*Nocturnal sleep duration (hours/night):* At W0, information on sleep duration was collected in the context of a standardized 24-h recall. Next to questions on dietary intakes, parents were asked about their child’s get up time in the morning as well as bed time (hour/minute) of the previous day. Nocturnal sleep duration was calculated as difference between bed time and get up time resulting in a continuous measure of sleep hours per night as described previously [6]. At W1 and W2, participants reported sleep duration in hours and minutes in self-completion questionnaires, i.e. the instructions read as follows: “What is the amount of time the child sleeps during a 24-hour period on weekdays? Give separate information for night time sleep and naps in the daytime.” Analogously, information was collected for weekend days/vacations. The weighted average of nocturnal sleep duration was calculated as follows: (nocturnal sleep duration on weekdays*5 + nocturnal sleep duration on weekend days*2) / 7. Reported usual sleep duration of < 5 hours/night or > 15 hours/night were considered implausible and set to missing.

*Average screen time (hours/week):* The time spent with audiovisual media was calculated based on the reported hours/minutes watching TV/video/DVD and hours/minutes sitting in front of a computer/game

console. In W2 and W3, additional information on web-based screen time like streaming movies was considered. A weighted average over weekdays and weekend days was calculated.

*Moderate to vigorous physical activity (MVPA; hours per day)*: Habitual PA was assessed using Actigraph accelerometers (Actigraph,LLC, Pensacola, FL, USA). In W0 and W1, either ActiTrainer or GT1M monitors were used, while in W2 either GT1M or GT3x + devices were used. Participants were asked to wear the accelerometers for at least 3 days (including 1 weekend day) at W0 and W1 and for 7 days at W2. Accelerometers were mounted on the right hip during waking hours of each child using an elastic belt adjusted to ensure close contact with the body. Details on processing of accelerometer data in the IDEFICS study as well as first descriptive results of accelerometer data of the IDEFICS study can be found in Konstabel et al. [7] Valid measurements were defined as recording more than 360 min of at least one weekday and one weekend day after exclusion of non-wear time according to Choi et al. [8] Non-wear time was identified using a 60 min window for each epoch to detect 30 min consecutive zero counts allowing breaks of 2 min of non-zeros. The threshold for valid measurements of at least 360 min for at least one weekday and one weekend day was chosen as a trade-off between accuracy and sample size and is discussed in Konstabel et al. [7] Before assigning intensity ranges, we here used a penalized expectile regression to smoothen the accelerometer counts that has been recently proposed in Wirsik et al. [9] MVPA and low physical activity (LPA) in minutes per day were then derived based on Evenson cut-off points for smoothed counts per minute (light: 104–2295, moderate: 2296–4011 cpm, vigorous: > 4011 cpm) [10]. Due to the compositional nature of the PA data, our models were adjusted for LPA when estimating the effects of interventions on MVPA on the incidence of OW/OB.

*Membership in sports club (yes vs no):* A variable indicating whether the child was member in a sports club was used as a proxy for physical activity.

*Active transport (yes vs no):* Active transport to/from kindergarten or school was considered in case the child usually gets to and from kindergarten/school either walking or cycling in W0, W1 and W2. In W3, times spend commuting to work/school and back home by walking, cycling, public transport, car/taxi or other transport modes were reported. If the times spend walking or cycling to work/school and back were greater than zero, an active form of transport was assumed.

Dietary variables

The following categorical variable was used to reflect the family meals: “Frequency of child eating while doing something else, e.g. watching TV, playing, sitting at a computer, looking at a book” (1=”Never or rarely”, 2=”Several times per week”, 3=”Once a day”, 4=”On several occasions per day”). Categories 1 and 2 as well as categories 3 and 4 were merged to derive a dichotomous variable with categories “Daily” vs “Non-daily”.

In W0, W1, W2 and W3 information on food frequencies were assessed based on the so-called Children’s Eating Habits Questionnaire–food frequency section (CEHQ-FFQ). The CEHQ-FFQ was designed as a screening tool to assess eating behaviors associated with overweight, obesity and general health in children. It covered 43 food times in W0, 46 in W1 and 58 in W2 with the following answer categories: ‘never/less than once a week’, ‘1–3 times a week’, ‘4–6 times a week’, ‘1 time per day’, ‘2 times per day’, ‘3 times per day’, ‘4 or more times per day’ and in W1 and W2 ‘I have no idea’.

These categories were converted into times per week ranging from 0 up to 30. Based on the converted food consumption frequencies, we calculated the following variables that were used in the present analyses:

- *Sugar-sweetened beverages (times/day):* In W0 and W1, sweetened drinks including sports drinks, bottled or canned tea, syrup-based drinks and similar; in W2 and W3 additionally carbonated sugar sweetened drinks, sweetened coffee and sweetened tea. In sensitivity analysis, we also included fruit juices in the calculation of SSB consumption frequencies. Reported consumption frequencies of > 8 times/day were considered implausible and set to missing.

**Supplementary Material S2**

**Imputation of missing values**

For the imputation, data were arranged in wide format, i.e. a new variable is built for each repeated measurement (W0, W1, W2, W3). Then standard FCS (fully conditional specification) imputation was performed once. All outcomes and exposures at the different assessment waves used in the final analyses were included in the procedure. The percentages of missing values ranged from 0% (age, sex) up to 49.5% (energy intake at W0) depending on the variable considered. For the majority of variables less than 5% of the values were missing. The outcome did not contain any missing values. Data were imputed sequentially for each wave. The number of missing values for all variables are presented in Supplementary Table S2 below.

MI combined with bootstrap is challenging and computationally intense such that we performed only a single imputation. We acknowledge that the calculation of the bootstrap confidence intervals (in course of the g-formula calculations) do not account for the uncertainty in the imputation.

| Variable | Label | N | Number missing values |
|---|---|---|---|
| **Wave 0 (N=10877)** | | | |
| **id** | **ID-Number** | 10877 | 0 |
| **country** | **Country** | 10877 | 0 |
| **sex** | **Sex of the child** | 10877 | 0 |
| **contr_interv** | **Study group (Control or Intervention)** | 10877 | 0 |
| **hist_obes** | **Family history of obesity (yes/no)** | 9468 | 1409 |
| **bf_total** | **Duration of total breastfeeding [months]** | 10356 | 521 |
| **age_birth** | **Pregnancy - mother's age at birth of child [years]** | 10447 | 430 |
| **preg_w_up** | **Pregnancy - mother's gained weight [kg]** | 9949 | 928 |
| **birth_w** | **Birth - child's weight [g]** | 10596 | 281 |
| **migrant** | **Migrant status of parents** | 10772 | 105 |
| **smoke_preg** | **Smoking during pregnancy** | 10197 | 680 |
| **preterm** | **Preterm birth (yes/no)** | 10709 | 168 |
| **wb_score** | **Well-being score** | 10103 | 774 |
| **time** | **Assessment wave** | 10877 | 0 |
| **eatdoelse** | **Child eating and doing something else** | 10747 | 130 |
| **water** | **Water consumption frequency** | 10300 | 577 |
| **SSB2** | **Sugar-sweetened beverages (excluding fruits juices)** | 10813 | 64 |
| **SSB** | **Sugar-sweetened beverages (including fruits juices)** | 10633 | 244 |
| **sleep_night** | **Nocturnal sleep duration (hours)** | 5939 | 4938 |
| **age** | **Age [years]** | 10877 | 0 |
| **bmi** | **Body Mass Index** | 10877 | 0 |
| **bmi_cat_cole_12** | **BMI in categories by Cole (2012)** | 10877 | 0 |
| **bmi_score_cole_12** | **z-score of BMI by Cole (2012)** | 10877 | 0 |
| **screen_time** | **Screen time (hours/day)** | 10551 | 326 |
| **isced_cat2011** | **ISCED-Category 2011: Max of both parents** | 10806 | 71 |
| **club_mbr** | **Leisure - child member in sports club** | 10544 | 333 |
| **act_transport** | **Active transport (yes/no)** | 10633 | 244 |
| **bmi_m** | **BMI of mother (kg/m2)** | 10530 | 347 |
| **energy_ex_MR** | **Usual energy intake excluding misreports (kcal/day)** | 6482 | 4395 |
| **Wave 1 (N=6871)** | | | |
| **wb_score_t1** | **Well-being score** | 6496 | 375 |
| **eatdoelse_t1** | **Child eating and doing something else** | 6811 | 60 |
| **water_t1** | **Water consumption frequency** | 6556 | 315 |

| | | | |
|---|---|---|---|
| **SSB2_t1** | **Sugar-sweetened beverages (excluding fruits juices)** | 6795 | 76 |
| **SSB_t1** | **Sugar-sweetened beverages (including fruits juices)** | 6699 | 172 |
| **sleep_night_t1** | **Nocturnal sleep duration (hours)** | 5979 | 892 |
| **age_t1** | **Age [years]** | 6871 | 0 |
| **bmi_t1** | **Body Mass Index** | 6871 | 0 |
| **bmi_cat_cole_12_t1** | **BMI in categories by Cole (2012)** | 6871 | 0 |
| **bmi_score_cole_12_t1** | **z-score of BMI by Cole (2012)** | 6871 | 0 |
| **screen_time_t1** | **Screen time (hours/day)** | 6683 | 188 |
| **isced_cat2011_t1** | **ISCED-Category 2011: Max of both parents** | 6775 | 96 |
| **club_mbr_t1** | **Leisure - child member in sports club** | 6673 | 198 |
| **act_transport_t1** | **Active transport (yes/no)** | 6728 | 143 |
| **bmi_m_t1** | **BMI of mother (kg/m2)** | 6596 | 275 |
| **Wave 2 (N=3023)** | | | |
| **wb_score_t3** | **Well-being score** | 2866 | 157 |
| **eatdoelse_t3** | **Child eating and doing something else** | 2996 | 27 |
| **water_t3** | **Water consumption frequency** | 3006 | 17 |
| **SSB2_t3** | **Sugar-sweetened beverages (excluding fruits juices)** | 3017 | 6 |
| **SSB_t3** | **Sugar-sweetened beverages (including fruits juices)** | 2994 | 29 |
| **sleep_night_t3** | **Nocturnal sleep duration (hours)** | 2941 | 82 |
| **age_t3** | **Age [years]** | 3023 | 0 |
| **bmi_t3** | **Body Mass Index** | 3023 | 0 |
| **bmi_cat_cole_12_t3** | **BMI in categories by Cole (2012)** | 3023 | 0 |
| **bmi_score_cole_12_t3** | **z-score of BMI by Cole (2012)** | 3023 | 0 |
| **screen_time_t3** | **Screen time (hours/day)** | 2618 | 405 |
| **isced_cat2011_t3** | **ISCED-Category 2011: Max of both parents** | 3010 | 13 |
| **club_mbr_t3** | **Leisure - child member in sports club** | 3003 | 20 |
| **act_transport_t3** | **Active transport (yes/no)** | 2967 | 56 |
| **bmi_m_t3** | **BMI of mother (kg/m2)** | 2253 | 770 |
| **Wave 3 (N=1466)** | | | |
| **eatdoelse_t5** | **Child eating and doing something else** | 1462 | 4 |
| **water_t5** | **Water consumption frequency** | 1458 | 8 |
| **SSB2_t5** | **Sugar-sweetened beverages (excluding fruits juices)** | 1461 | 5 |
| **SSB_t5** | **Sugar-sweetened beverages (including fruits juices)** | 1452 | 14 |
| **sleep_night_t5** | **Nocturnal sleep duration (hours)** | 1450 | 16 |
| **age_t5** | **Age [years]** | 1466 | 0 |
| **bmi_t5** | **Body Mass Index** | 1454 | 12 |
| **bmi_cat_cole_12_t5** | **BMI in categories by Cole (2012)** | 1454 | 12 |
| **bmi_score_cole_12_t5** | **z-score of BMI by Cole (2012)** | 1454 | 12 |
| **screen_time_t5** | **Screen time (hours/day)** | 1296 | 170 |
| **club_mbr_t5** | **Leisure - child member in sports club** | 1459 | 7 |
| **act_transport_t5** | **Active transport (yes/no)** | 1336 | 130 |

**Supplementary Table 2:** Number of missing values for all variables at the different assessment waves

**Supplementary Material S3: Identifying assumptions and their plausibility**

*Conditional and sequential exchangeability:* This assumption demands that the potential outcomes under certain fixed exposure levels are independent of the observed exposures. It is made within levels of past observed covariate values (conditional) and at each time point (sequentially). Informally, we speak of “no unmeasured confounding”. As a common issue in observational data, unmeasured confounding cannot be fully excluded e.g. due to lack of genetic information. However, we adjusted for many potential (time-dependent) confounders and considered proxy indicators for missing confounders like e.g. the family history of obesity for genetic factors.

*Causal consistency:* This assumption is fulfilled when the treatment strategies being assessed are well-defined and correspond to the treatment strategies observed in the data, e.g. the outcome for a subject who happens to adhere to sleep time recommendations is the same as if he/she had been assigned to adhere to sleep time recommendations in the target trial, which is plausible.

*Positivity:* The validity of the results relies on the assumption of positivity, which requires that all intervention strategies should be observed within joint cross-classification of all confounders. The positivity assumption was checked empirically. Random non-positivity seems a potential concern for our causal analysis as there are only few subjects who observationally adhered to the joint interventions. By using the g-formula, we implicitly accept the model-based counterfactual extrapolation for covariate-exposure combinations where data are sparse. However, under correct models, the parametric g-formula is less prone to bias induced by positivity violations as compared to e.g. inverse probability weighting [11]. In our study, we conducted a sensitivity analysis using inverse probability of censoring weighting (IPCW) instead of the g-formula for estimating the risk under the natural course from the observed data and did not find substantial differences. When comparing our g-formula estimates under the natural course with those obtained based on inverse probability of censoring weighting (IPCW), less than 1% of our study population obtained a large weight (weights up to 1865) suggesting that violation of positivity is a problem in less than 1% of our population.

*Correct model specification:* The g-formula requires correct specification of the conditional (on the past) probabilities of the outcome and time-varying covariates in all follow-up intervals. Due to the use of multiple models, the parametric g-formula is especially vulnerable to the assumption of correct model specification. Informal checking is possible by comparison of the

observed data to the data simulated under the natural course. We compared the observed means of the outcome and time-varying covariates with those predicted by our models. The parametric g-formula closely replicated the observed risk and the mean covariates under the natural course.

## Supplementary Material S4: Tables S4a and S4b

| Variable | Purpose | Time period of variable assessment | Type of model when used as dependent variable | Functional form when used as predictor | Modelling type selected in SAS macro[#] for covariate history (covXptype) |
|---|---|---|---|---|---|
| **Baseline** | | | | | |
| Age at cohort entry<br>Age squared<br>Age cubic | Confounder | Baseline | Not predicted | Continuous | |
| Sex | Confounder | Baseline | Not predicted | Binary | |
| Region of residence | Confounder | Baseline | Not predicted | Categorical (3 categories) | |
| Parental educational level | Confounder | Baseline | Not predicted | Categorical (3 categories) | |
| Migrant status | Confounder | Baseline | Not predicted | Binary | |
| Pregnancy weight gain | Confounder | Baseline | Not predicted | Continuous | |
| Maternal age at birth | Confounder | Baseline | Not predicted | Continuous | |
| Indicator for preterm birth | Confounder | Baseline | Not predicted | Binary | |
| Smoking during pregnancy | Confounder | Baseline | Not predicted | Binary | |
| Total breast feeding duration | Confounder | Baseline | Not predicted | Continuous | |
| Baseline energy intake | Confounder | Baseline | Not predicted | Continuous | |
| Family history of obesity | Confounder | Baseline | Not predicted | Binary | |
| Control vs intervention region | Confounder | Baseline | Not predicted | Binary | |
| Baseline maternal BMI | Confounder | Baseline | Not predicted | Continuous | |
| Baseline screen time | Confounder | Baseline | Not predicted | Continuous | |
| Baseline membership in sports club | Confounder | Baseline | Not predicted | Binary | |
| Baseline Sleep duration | Confounder | Baseline | Not predicted | Continuous | |
| Baseline eating while doing something else | Confounder | Baseline | Not predicted | Binary | |

| | | | | | |
|---|---|---|---|---|---|
| Baseline SSB consumption frequency | Confounder | Baseline | Not predicted | Continuous | |
| **Time-varying factors** | | | | | |
| Time since baseline | Covariate | Post-baseline | Truncated regression | Continuous | lag1qdc |
| Maternal BMI | Confounder | Post-baseline | Tobit regression | Continuous | lag1qdc |
| Well-being score* | Confounder | Post-baseline | Tobit regression | Continuous | lag1qdc |
| Screen time | Exposure/confounder | | Tobit regression | Continuous | lag1qdc |
| Membership in sports club | Exposure/confounder | Post-baseline | Logistic | Binary | lag1bin |
| Active transport | Exposure/confounder | Post-baseline | Logistic | Binary | lag1bin |
| Sleep duration | Exposure/confounder | Post-baseline | Truncated regression | Continuous | lag1qdc |
| Eating while doing something else | Exposure/confounder | Post-baseline | Logistic | Binary | lag1bin |
| SSB consumption frequency | Exposure/confounder | Post-baseline | Logistic and linear | Continuous | lag1bin |
| **Other important factors that could not be considered** | | **Reason not accounting for the variable** | | | |
| Pubertal status | Confounder | Only assessed in subgroup at W2 | | | |

**Table S4a:** Functional form and type of model chosen for the covariates when being used as predictor/ response variable in the 6-year and 13-year analyses based on the entire study sample

#Details are given in the user guide of the GFORMULA SAS macro available at *www.hsph.harvard.edu/causal/software*

*Well-being score was only assessed from W0 to W2, but not in W3, and was hence only considered in the 6-year analyses

| Variable | Purpose | Time period of variable assessment | Type of model when used as dependent variable | Functional form when used as predictor | Modelling type selected in SAS macro[#] for covariate history (covXptype) |
|---|---|---|---|---|---|
| **Baseline** | | | | | |
| Age at cohort entry<br>Age squared<br>Age cubic | Confounder | Baseline | Not predicted | Continuous | |
| Sex | Confounder | Baseline | Not predicted | Binary | |
| Region of residence | Confounder | Baseline | Not predicted | Categorical (3 categories) | |
| Parental educational level | Confounder | Baseline | Not predicted | Categorical (3 categories) | |
| Migrant status | Confounder | Baseline | Not predicted | Binary | |
| Pregnancy weight gain | Confounder | Baseline | Not predicted | Continuous | |
| Maternal age at birth | Confounder | Baseline | Not predicted | Continuous | |
| Indicator for preterm birth | Confounder | Baseline | Not predicted | Binary | |
| Smoking during pregnancy | Confounder | Baseline | Not predicted | Binary | |
| Total breast feeding duration | Confounder | Baseline | Not predicted | Continuous | |
| Baseline energy intake | Confounder | Baseline | Not predicted | Continuous | |
| Family history of obesity | Confounder | Baseline | Not predicted | Binary | |
| Control vs intervention region | Confounder | Baseline | Not predicted | Binary | |
| Baseline maternal BMI | Confounder | Baseline | Not predicted | Continuous | |
| Baseline screen time | Confounder | Baseline | Not predicted | Continuous | |
| Baseline Sleep duration | Confounder | Baseline | Not predicted | Continuous | |
| Baseline SSB consumption frequency | Confounder | Baseline | Not predicted | Continuous | |
| Baseline MVPA | Confounder | Baseline | Not predicted | Continuous | |

| | | | | | |
|---|---|---|---|---|---|
| Baseline LPA | Confounder | Baseline | Not predicted | Continuous | |
| **Time-varying factors** | | | | | |
| Time since baseline | Covariate | Post-baseline | Truncated regression | Continuous | lag1qdc |
| Maternal BMI | Confounder | Post-baseline | Tobit regression | Continuous | lag1qdc |
| Well-being score* | Confounder | Post-baseline | Tobit regression | Continuous | lag1qdc |
| Screen time | Confounder | Post-baseline | Tobit regression | Continuous | lag1qdc |
| Valid wear time | Confounder | Post-baseline | Tobit regression | Continuous | lag1bin |
| LPA | Confounder | Post-baseline | Tobit regression | Continuous | lag1bin |
| MVPA | Exposure | Post-baseline | Tobit regression | Continuous | lag1bin |
| Sleep duration | Confounder | Post-baseline | Truncated regression | Continuous | lag1qdc |
| SSB consumption frequency | Confounder | Post-baseline | Logistic and linear | Continuous | lag1bin |
| **Other important factors that could not be considered** | | **Reason not accounting for the variable** | | | |
| Pubertal status | Confounder | Only assessed in subgroup at W2 | | | |

**Table S4b:** Functional form and type of model chosen for the covariates when being used as predictor/ response variable in the analyses for interventions on MVPA based on the subgroup with accelerometer data

[#]Details are given in the user guide of the GFORMULA SAS macro available at *www.hsph.harvard.edu/causal/software*

[*]Well-being score was only assessed in W0 to W2, but not in W3, and was hence only considered in the 6-year analyses

**Supplementary Material S5**

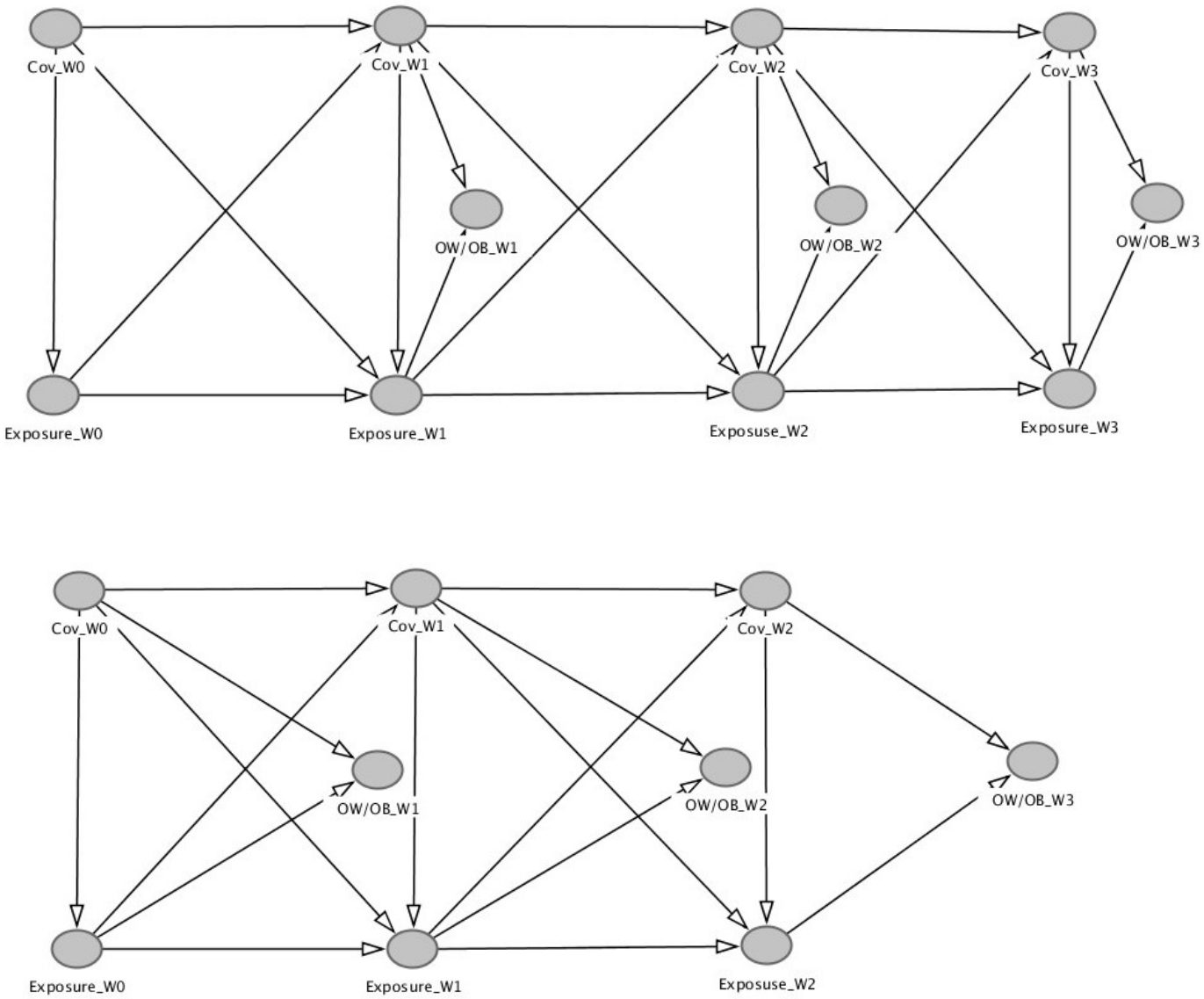


**Figure S5:** Assumed time-order between covariates, exposures and outcome in model allowing contemporaneous effects (upper panel) and in model allowing only time-delayed effects (lower panel); arrows e.g. from covariates at W0 to covariates/exposures/outcomes at later time points were omitted for clarity

**Supplementary Material S6**

| | W0 | | W1 | | W2 | | W3 | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| **Total number of study subjects** | 10877 | | 6871 | | 3023 | | 1466 | |
| **Adherence to all recommendations** | 810 | 7.5 | 780 | 11.4 | 179 | 5.9 | 45 | 3.1 |
| **Sleep recommendation** | 8972 | 82.5 | 6023 | 87.7 | 2365 | 78.2 | 1002 | 68.4 |
| **Screen time recommendation** | 5881 | 54.1 | 3577 | 52.1 | 988 | 32.7 | 340 | 23.2 |
| **Use of active form of transport** | 4258 | 39.2 | 3051 | 44.4 | 1405 | 46.5 | 1083 | 73.9 |
| **SSB recommendation** | 8924 | 82.0 | 5904 | 85.9 | 1873 | 62.0 | 836 | 57.0 |
| **Membership in a sports club** | 4727 | 43.5 | 4360 | 63.5 | 2194 | 72.6 | 912 | 62.2 |
| **Non-daily eating while doing something else** | 8854 | 81.4 | 5619 | 81.8 | 2130 | 70.5 | 689 | 47.0 |

**Table S6a:** Numbers and percentages of children adhering observationally to the different recommendations at W0 to W3 as well as numbers and percentages of children adhering to all recommendations

| | W0 | | W1 | | W2 | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| **Total number of study subjects** | 2203 | | 2061 | | 1243 | |
| **Adhere to MVPA recommendation** | 678 | 30.78 | 800 | 38.82 | 453 | 36.44 |

**Table S6b:** Numbers and percentages of children adhering to MVPA recommendation at W0 to W2

**Supplementary Material S7:** Graphical display of population risk differences and 95% confidence intervals using the g-formula when intervening only on children of mother's with BMI > 25 kg/m$^2$ and children of parents with low/medium ISCED level at baseline

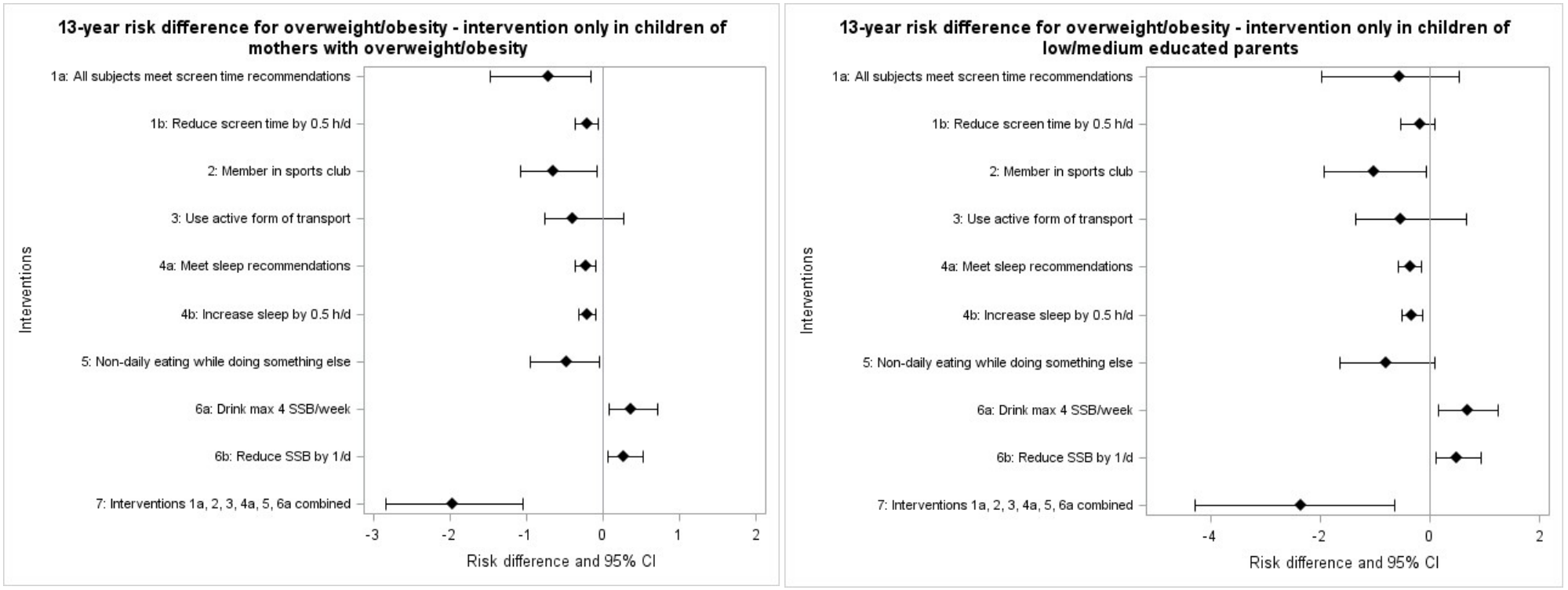


**Figure S7:** Population risk differences and 95% confidence intervals using the g-formula. Hypothetical interventions on children of mother's with BMI > 25 kg/m$^2$ (left panel) and children of parents with low/medium ISCED level at baseline (right panel) using data from W0 to W3. Model allowing contemporaneous effects of exposures on the outcome.

**Supplementary Material S8: Intervention effects on risk of developing overweight/obesity when intervening only on males/females or younger/older children**

| | Intervention effects when intervening only on males | Risk (%) | 95% LCL | 95% UCL | Population risk ratio | 95% LCL | 95% UCL | Population risk difference | 95% LCL | 95% UCL | Cumulative % intervened[a] | Average % intervened[b] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Natural course | 30.7 | 28.4 | 32.7 | **1** | 1 | 1 | **0** | 0 | 0 | 0.0 | 0.0 |
| 1a | All subjects meet screen time recommendations | **30.2** | 27.6 | 32.0 | **0.98** | 0.94 | 1.03 | **-0.51** | -1.98 | 0.83 | 50.7 | 40.6 |
| 1b | All subjects reduce screen time by 0.5 hours/day | **30.5** | 28.3 | 32.7 | **1** | 0.98 | 1 | **-0.15** | -0.45 | 0.14 | 50.7 | 40.6 |
| 2 | All subjects are members in sports club | **29.2** | 26.9 | 31.5 | **0.95** | 0.93 | 0.99 | **-1.47** | -2.29 | -0.42 | 39.3 | 15.9 |
| 3 | All subjects use an active form of transport | **30.1** | 27.9 | 32.1 | **0.98** | 0.96 | 1.01 | **-0.61** | -1.13 | 0.28 | 40.1 | 18.4 |
| 4a | All subjects meet sleep recommendations | **30.4** | 27.9 | 32.2 | **0.99** | 0.98 | 1 | **-0.32** | -0.58 | -0.08 | 30.8 | 19.9 |
| 4b | All subjects increase sleep by 0.5 hours | **30.4** | 27.9 | 32.2 | **0.99** | 0.98 | 1 | **-0.29** | -0.52 | -0.07 | 30.8 | 19.9 |
| 5 | All subjects non-daily eat while doing something else | **29.5** | 27.0 | 31.5 | **0.96** | 0.93 | 0.99 | **-1.19** | -2.26 | -0.35 | 37.7 | 15.2 |
| 6a | All subjects drink max 4 SSB per week | **31.1** | 28.6 | 33.1 | **1.01** | 1 | 1.03 | **0.44** | -0.05 | 1.01 | 41.5 | 25.0 |
| 6b | All subjects reduce SSB by 1/day | **31.0** | 28.5 | 33.0 | **1.01** | 1 | 1.03 | **0.33** | -0.03 | 0.75 | 41.5 | 25.0 |
| 7 | All subjects adhere to recommendation for all variables | **27.4** | 24.4 | 30.0 | **0.89** | 0.85 | 0.95 | **-3.25** | -4.58 | -1.64 | 51.6 | 48.4 |

**Table S8a:** Population risk estimates using the g-formula. Hypothetical interventions on male subjects using data from W0 to W3 allowing contemporaneous effects of exposures on the outcome

[a] The cumulative percent intervened on is the percent of the population required to change behavior in at least one wave

[b]The average percent intervened on is the average, across all waves, of the percent of the study population required to change behavior in a given wave

| | Intervention effects when intervening only on females | Risk (%) | 95% LCL | 95% UCL | Population risk ratio | 95% LCL | 95% UCL | Population risk difference | 95% LCL | 95% UCL | Cumulative % intervened[a] | Average % intervened[b] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Natural course | 30.7 | 28.4 | 32.7 | **1** | 1 | 1 | **0** | 0 | 0 | 0.0 | 0.0 |
| 1a | All subjects meet screen time recommendations | **29.0** | 26.6 | 30.6 | **0.94** | 0.91 | 0.98 | **-1.69** | -2.67 | -0.59 | 46.3 | 34.5 |
| 1b | All subjects reduce screen time by 0.5 hours/day | **30.2** | 28.0 | 32.3 | **0.98** | 0.98 | 0.99 | **-0.49** | -0.74 | -0.18 | 46.3 | 34.5 |
| 2 | All subjects are members in sports club | **30.4** | 28.0 | 32.5 | **0.99** | 0.97 | 1.03 | **-0.26** | -1.03 | 0.79 | 37.6 | 15.9 |
| 3 | All subjects use an active form of transport | **30.2** | 28.0 | 31.9 | **0.98** | 0.96 | 1.01 | **-0.51** | -1.15 | 0.27 | 37.6 | 17.6 |
| 4a | All subjects meet sleep recommendations | **30.3** | 28.0 | 32.4 | **0.99** | 0.98 | 1 | **-0.33** | -0.56 | -0.03 | 27.7 | 17.8 |
| 4b | All subjects increase sleep by 0.5 hours | **30.4** | 28.1 | 32.4 | **0.99** | 0.98 | 1 | **-0.3** | -0.5 | -0.02 | 27.7 | 17.8 |
| 5 | All subjects non-daily eat while doing something else | **30.7** | 28.3 | 32.8 | **1** | 0.97 | 1.03 | **0.07** | -0.83 | 1.03 | 33.1 | 12.8 |
| 6a | All subjects drink max 4 SSB per week | **31.2** | 29.0 | 33.2 | **1.02** | 1 | 1.03 | **0.53** | -0.05 | 1.01 | 36.6 | 21.5 |
| 6b | All subjects reduce SSB by 1/day | **31.1** | 28.8 | 33.1 | **1.01** | 1 | 1.02 | **0.4** | -0.03 | 0.78 | 36.6 | 21.5 |
| 7 | All subjects adhere to recommendation for all variables | **28.6** | 25.8 | 30.7 | **0.93** | 0.88 | 0.98 | **-2.06** | -3.56 | -0.56 | 48.4 | 44.7 |

**Table S8b:** Population risk estimates using the g-formula. Hypothetical interventions on female subjects using data from W0 to W3 allowing contemporaneous effects of exposures on the outcome

[a] The cumulative percent intervened on is the percent of the population required to change behavior in at least one wave

[b]The average percent intervened on is the average, across all waves, of the percent of the study population required to change behavior in a given wave

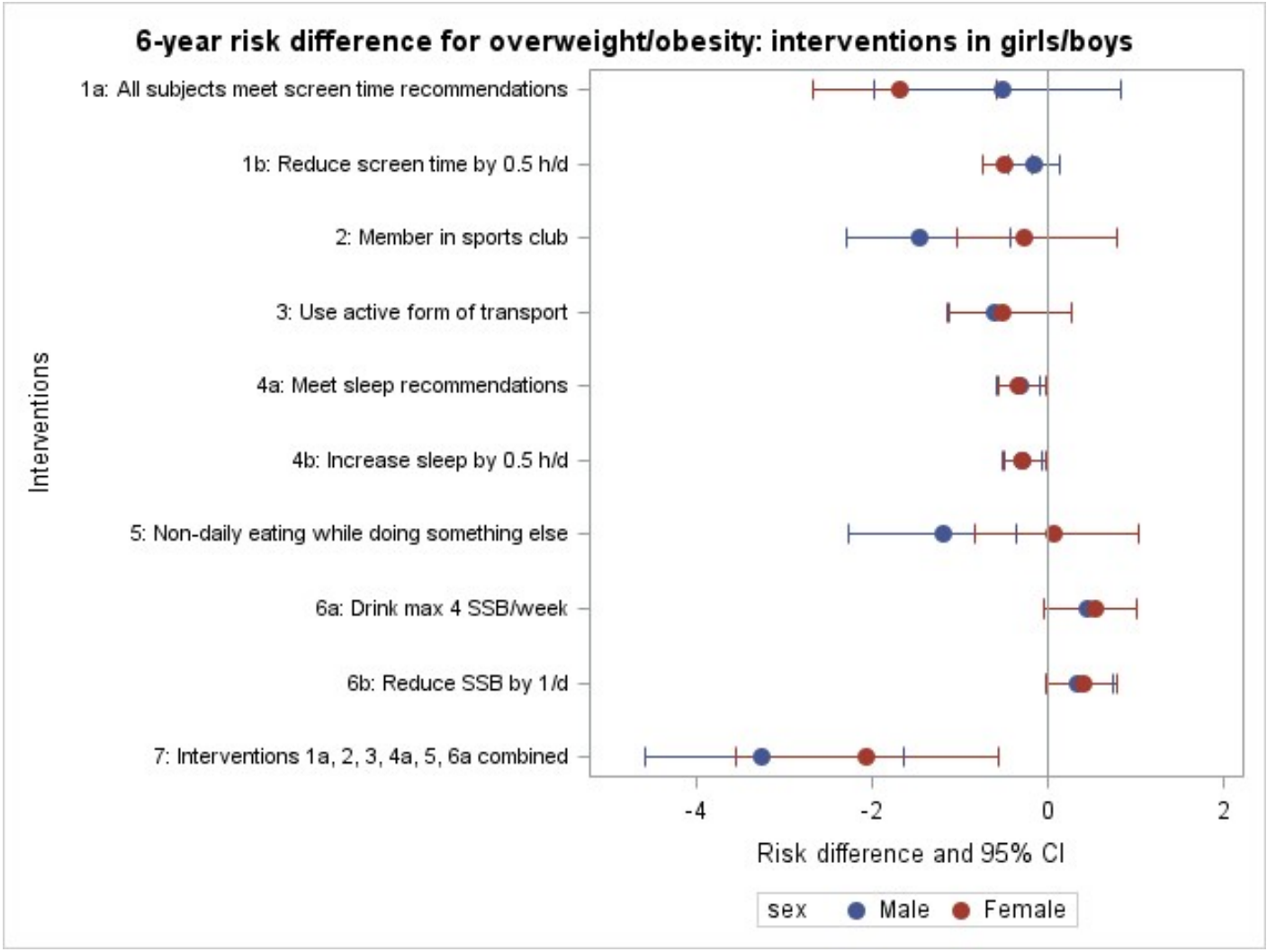


**Figure S8c:** Graphical display of population risk differences and 95% confidence intervals using the g-formula when intervening only in girls or when intervening only in boys

| | Intervention effects when intervening only on < 6 year olds | Risk (%) | 95% LCL | 95% UCL | Population risk ratio | 95% LCL | 95% UCL | Population risk difference | 95% LCL | 95% UCL | Cumulative % intervened[a] | Average % intervened[b] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Natural course | 30.7 | 28.4 | 32.7 | **1** | 1 | 1 | **0** | 0 | 0 | 0.0 | 0.0 |
| 1a | All subjects meet screen time recommendations | **28.8** | 26.5 | 30.6 | **0.94** | 0.9 | 0.97 | **-1.85** | -3.08 | -0.86 | 48.4 | 39.4 |
| 1b | All subjects reduce screen time by 0.5 hours/day | **30.1** | 28.0 | 32.2 | **0.98** | 0.97 | 0.99 | **-0.52** | -0.87 | -0.28 | 48.4 | 39.4 |
| 2 | All subjects are members in sports club | **30.6** | 28.3 | 32.5 | **1** | 0.97 | 1.03 | **-0.1** | -1 | 0.84 | 42.4 | 17.9 |
| 3 | All subjects use an active form of transport | **30.1** | 27.6 | 31.8 | **0.98** | 0.95 | 1.02 | **-0.57** | -1.42 | 0.68 | 40.5 | 19.0 |
| 4a | All subjects meet sleep recommendations | **30.3** | 27.8 | 32.2 | **0.99** | 0.98 | 0.99 | **-0.39** | -0.65 | -0.17 | 34.2 | 23.8 |
| 4b | All subjects increase sleep by 0.5 hours | **30.3** | 27.9 | 32.3 | **0.99** | 0.98 | 1 | **-0.34** | -0.55 | -0.14 | 34.2 | 23.8 |
| 5 | All subjects non-daily eat while doing something else | **30.1** | 27.9 | 32.4 | **0.98** | 0.95 | 1.01 | **-0.58** | -1.46 | 0.3 | 34.2 | 13.5 |
| 6a | All subjects drink max 4 SSB per week | **31.0** | 28.7 | 33.1 | **1.01** | 1 | 1.03 | **0.32** | -0.09 | 0.75 | 36.7 | 21.2 |
| 6b | All subjects reduce SSB by 1/day | **30.9** | 28.6 | 33.0 | **1.01** | 1 | 1.02 | **0.25** | -0.06 | 0.58 | 36.7 | 21.2 |
| 7 | All subjects adhere to recommendation for all variables | **27.8** | 25.0 | 29.9 | **0.91** | 0.86 | 0.97 | **-2.84** | -4.18 | -0.99 | 50.0 | 47.2 |

**Table S8d:** Population risk estimates using the g-formula. Hypothetical interventions on subjects aged < 6 years at baseline using data from W0 to W3 allowing contemporaneous effects of exposures on the outcome

[a] The cumulative percent intervened on is the percent of the population required to change behavior in at least one wave

[b]The average percent intervened on is the average, across all waves, of the percent of the study population required to change behavior in a given wave

| | Intervention effects when intervening only on ≥ 6 year olds | Risk (%) | 95% LCL | 95% UCL | Population risk ratio | 95% LCL | 95% UCL | Population risk difference | 95% LCL | 95% UCL | Cumulative % intervened[a] | Average % intervened[b] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Natural course | 30.7 | 28.4 | 32.7 | **1** | 1 | 1 | **0** | 0 | 0 | 0.0 | 0.0 |
| 1a | All subjects meet screen time recommendations | **30.3** | 28.0 | 32.5 | **0.99** | 0.95 | 1.03 | **-0.36** | -1.44 | 0.85 | 48.7 | 35.7 |
| 1b | All subjects reduce screen time by 0.5 hours/day | **30.6** | 28.2 | 32.7 | **1** | 0.99 | 1.01 | **-0.12** | -0.37 | 0.15 | 48.7 | 35.7 |
| 2 | All subjects are members in sports club | **29.2** | 26.7 | 31.3 | **0.95** | 0.93 | 0.97 | **-1.5** | -2.21 | -0.87 | 34.8 | 14.1 |
| 3 | All subjects use an active form of transport | **30.1** | 27.6 | 32.4 | **0.98** | 0.95 | 1.01 | **-0.55** | -1.51 | 0.38 | 37.9 | 16.9 |
| 4a | All subjects meet sleep recommendations | **30.4** | 28.0 | 32.4 | **0.99** | 0.99 | 1 | **-0.26** | -0.41 | -0.11 | 24.3 | 13.9 |
| 4b | All subjects increase sleep by 0.5 hours | **30.4** | 28.0 | 32.4 | **0.99** | 0.99 | 1 | **-0.25** | -0.4 | -0.11 | 24.3 | 13.9 |
| 5 | All subjects non-daily eat while doing something else | **30.0** | 27.6 | 32.4 | **0.98** | 0.95 | 1.01 | **-0.7** | -1.55 | 0.23 | 36.2 | 14.4 |
| 6a | All subjects drink max 4 SSB per week | **31.3** | 28.9 | 33.3 | **1.02** | 1 | 1.04 | **0.65** | 0.11 | 1.22 | 41.3 | 25.2 |
| 6b | All subjects reduce SSB by 1/day | **31.1** | 28.8 | 33.2 | **1.02** | 1 | 1.03 | **0.48** | 0.09 | 0.93 | 41.3 | 25.2 |
| 7 | All subjects adhere to recommendation for all variables | **28.2** | 25.6 | 31.1 | **0.92** | 0.86 | 0.98 | **-2.48** | -4.17 | -0.57 | 50.0 | 45.9 |

**Table S8e:** Population risk estimates using the g-formula. Hypothetical interventions on subjects aged ≥ 6 years at baseline using data from W0 to W3 allowing contemporaneous effects of exposures on the outcome

[a] The cumulative percent intervened on is the percent of the population required to change behavior in at least one wave

[b]The average percent intervened on is the average, across all waves, of the percent of the study population required to change behavior in a given wave

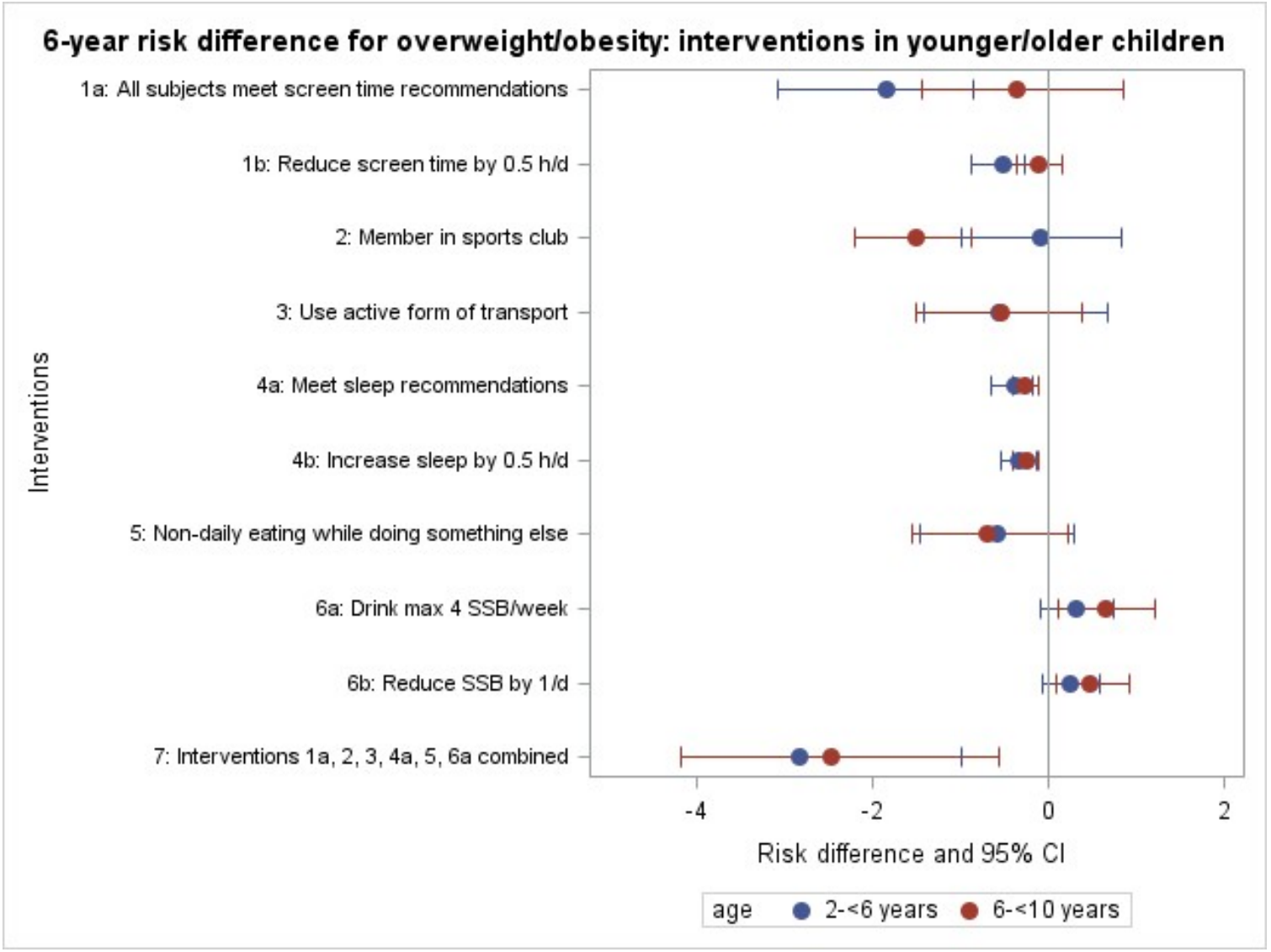


**Figure S8f:** Graphical display of population risk differences and 95% confidence intervals using the g-formula when intervening only in children 2 to <6 years vs in children 6 to <10 years

**Supplementary Material S9**

| **Only time-delayed effects**<br>Observed risk: 31.4 | **Risk (%)** | **95% LCL** | **95% UCL** | **Population risk ratio** | **95% LCL** | **95% UCL** | **Population risk difference** | **95% LCL** | **95% UCL** | **Cumulative % intervened[a]** | **Average % intervened[b]** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 Natural course | **31.0** | 29.7 | 32.8 | **1** | 1 | 1 | **0** | 0 | 0 | 0.0 | 0.0 |
| 1a All subjects meet screen time recommendations | **28.0** | 26.1 | 30.1 | **0.9** | 0.85 | 0.95 | **-2.98** | -4.72 | -1.58 | 87.3 | 59.9 |
| 1b All subjects reduce screen time by 0.5 hours/day | **30.0** | 28.7 | 31.7 | **0.97** | 0.95 | 0.98 | **-0.96** | -1.45 | -0.51 | 87.3 | 59.9 |
| 2 All subjects are members in sports club | **29.8** | 27.5 | 32.7 | **0.96** | 0.91 | 1.02 | **-1.19** | -2.62 | 0.62 | 66.4 | 30.9 |
| 3 All subjects use an active form of transport | **30.4** | 28.0 | 32.9 | **0.98** | 0.92 | 1.04 | **-0.62** | -2.56 | 1.05 | 77.8 | 37.4 |
| 4a All subjects meet sleep recommendations | **30.9** | 29.7 | 32.7 | **1** | 0.99 | 1 | **-0.14** | -0.26 | -0.01 | 15.6 | 13.6 |
| 4b All subjects increase sleep by 0.5 hours | **30.9** | 29.7 | 32.7 | **1** | 0.99 | 1 | **-0.13** | -0.26 | -0.01 | 15.6 | 13.6 |
| 5 All subjects non-daily eat while doing something else | **30.5** | 28.4 | 32.6 | **0.98** | 0.95 | 1.03 | **-0.51** | -1.75 | 0.8 | 43.9 | 20.2 |
| 6a All subjects drink max 4 SSB per week | **31.0** | 29.5 | 32.9 | **1** | 0.98 | 1.02 | **-0.01** | -0.6 | 0.51 | 58.0 | 33.6 |
| 6b All subjects reduce SSB by 1/day | **31.0** | 29.6 | 32.9 | **1** | 0.99 | 1.01 | **0** | -0.45 | 0.39 | 58.0 | 33.6 |
| 7 All subjects adhere to recommendation for all variables | **26.6** | 23.4 | 29.9 | **0.86** | 0.77 | 0.96 | **-4.41** | -7.03 | -1.35 | 98.5 | 78.4 |

**Table S9a:** Population risk estimates using the g-formula. Hypothetical interventions on entire cohort using data from W0 to W3 allowing only time-delayed (but not contemporaneous) effects of exposures on the outcome

[a] The cumulative percent intervened on is the percent of the population required to change behavior in at least one wave

[b]The average percent intervened on is the average, across all waves, of the percent of the study population required to change behavior in a given wave

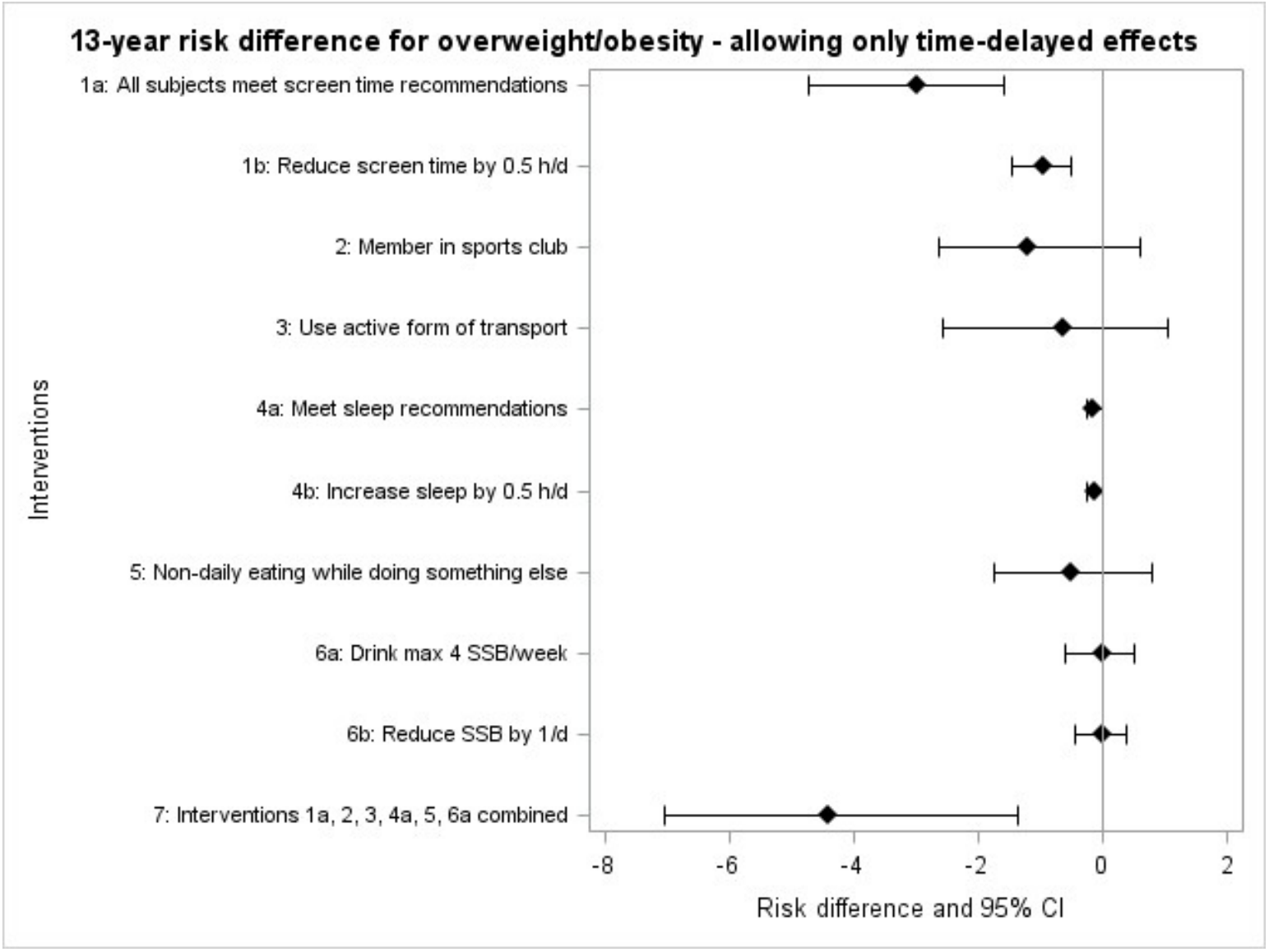


**Figure S9b:** Graphical display of population risk differences and 95% confidence intervals using the g-formula when allowing only time-delayed effects

**Supplementary Material S10**

| | **Effects after 6 years**<br>Observed risk: 22.5 | **Risk (%)** | **95% LCL** | **95% UCL** | **Population risk ratio** | **95% LCL** | **95% UCL** | **Population risk difference** | **95% LCL** | **95% UCL** | **Cumulative % intervened on[a]** | **Average % intervened on[b]** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Natural course | **22.5** | 21.3 | 23.7 | **1** | 1 | 1 | **0** | 0 | 0 | 0.0 | 0.0 |
| 1a | All subjects meet screen time recommendations | **20.1** | 18.2 | 21.6 | **0.90** | 0.85 | 0.94 | **-2.33** | -3.61 | -1.33 | 89.4 | 68.3 |
| 1b | All subjects reduce screen time by 0.5 hours/day | **21.6** | 20.2 | 22.8 | **0.96** | 0.94 | 0.98 | **-0.85** | -1.26 | -0.44 | 89.4 | 68.3 |
| 2 | All subjects are members in sports club | **21.3** | 19.5 | 22.8 | **0.95** | 0.91 | 0.99 | **-1.17** | -2.09 | -0.26 | 70.0 | 33.7 |
| 3 | All subjects use an active form of transport | **21.6** | 19.8 | 23.6 | **0.96** | 0.92 | 1.03 | **-0.84** | -1.82 | 0.61 | 78.8 | 37.8 |
| 4a | All subjects meet sleep recommendations | **22.0** | 20.7 | 23.3 | **0.98** | 0.96 | 0.99 | **-0.49** | -0.83 | -0.25 | 47.1 | 32.2 |
| 4b | All subjects increase sleep by 0.5 hours | **22.0** | 20.8 | 23.3 | **0.98** | 0.97 | 0.99 | **-0.45** | -0.73 | -0.22 | 47.1 | 32.2 |
| 5 | All subjects non-daily eat while doing something else | **22.2** | 20.9 | 23.8 | **0.99** | 0.95 | 1.02 | **-0.31** | -1.09 | 0.5 | 46.8 | 21.1 |
| 6a | All subjects drink max 4 SSB per week | **23.2** | 21.2 | 25.3 | **1.03** | 0.99 | 1.09 | **0.76** | -0.12 | 1.83 | 90.9 | 75.4 |
| 6b | All subjects reduce SSB by 1/day | **23.0** | 21.3 | 24.7 | **1.02** | 1 | 1.06 | **0.51** | -0.09 | 1.22 | 90.9 | 75.4 |
| 7 | All subjects adhere to recommendation for all variables | **18.6** | 16.4 | 20.5 | **0.83** | 0.74 | 0.9 | **-3.89** | -5.95 | -2.28 | 99.9 | 94.2 |

**Table S10a:** Population risk estimates using the g-formula. Hypothetical interventions on entire cohort using data from W0 to W2, i.e. over 6-year period, allowing contemporaneous effects of exposures on the outcome

[a] The cumulative percent intervened on is the percent of the population required to change behavior in at least one wave

[b]The average percent intervened on is the average, across all waves, of the percent of the study population required to change behavior in a given wave

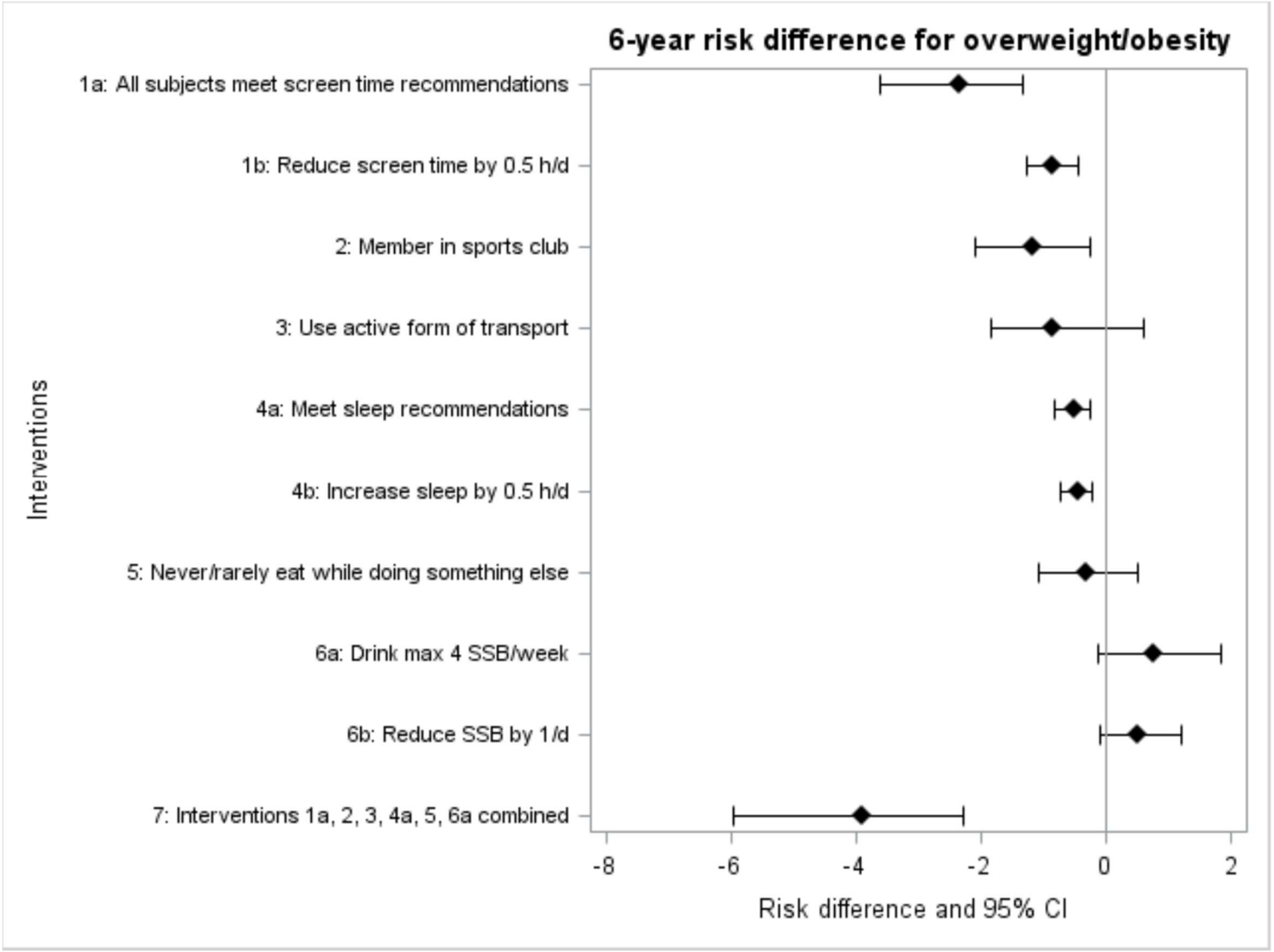


**Figure S10b:** Graphical display of population risk differences and 95% confidence intervals using the g-formula: estimates over a 6-year period

**Supplementary Material S11: Sensitivity analysis adding the distance to school/kindergarten/work as an additional time-varying covariate**

The distance to school/kindergarten is certainly a predictor of using an active form of transport, i.e. related to our exposure of interest. However, another necessary condition for a confounder is that the confounder (distance) is separately predictive (given the other confounders already included) of the outcome of interest (OW/OB in our case). As we do not believe that the latter condition is met, we opted to not adjust for the distance to school/kindergarten in our main analyses, but did so in a sensitivity analysis:

In a first step, we harmonized our measures of distance to school/kindergarten at the different waves. In W0/W1, the distance was queried based on a multiple-choice question. Continuous values were assigned to the categories as follows:
‘0 to 1 km’= 0.5,
‘1 to 2 km’= 1.5,
‘2 to 3 km’= 2.5,
‘3 to 4 km’= 3.5,
‘More than 4 km’= 4.5
In W2/W3 the distance was queried based on an open question (continuous in km). The values were truncated at 10 km as the categories at W0/W1 did not capture high distances and the skewness led to convergence problems when applying the parametric g-formula. We then added this harmonized variable (distance to work/school/kindergarten in km) as a time-varying covariate to our main model.

The effect of active transport on the incidence of OW/OB increased (risk difference: 1.99 [-3.80;-0.29]) while effects of all single interventions remained similar. The effect of the joint intervention increased (corresponding to the increase of the effect of active transport; risk difference 6.02 [-9.01;-3.82]).

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