

Supplementary material

Prospective association of air-purifier usage during pregnancy with infant neurodevelopment: A nationwide longitudinal study – Japan Environment and Children's Study (JECS)

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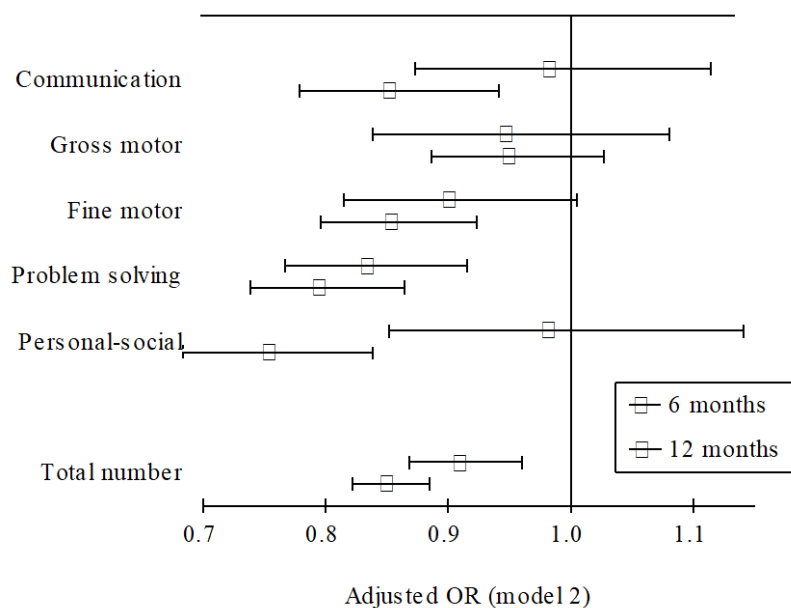


Figure S1. Adjusted ORs (model 2) and 95% confidence intervals (bars) of air-purifier usage for screen-positive cases of developmental delay assessed using the ASQ-3 with air-purifier nonuse set as a reference.

This graph was drawn using the results of the complete case analysis.

OR, odds ratio; ASQ-3, Ages & Stages Questionnaire, Third edition; Total number, total number of screen-positive cases over five developmental areas in the ASQ-3.

Model 2 = full model adjusted for maternal age, body mass index, parity, smoking status, passive smoking status, alcohol intake, number of hours spent outdoors, physical activity, folic acid intake, marital status, highest educational level, employment status, annual household income, type of residence, high-rise living, number of rooms in the house/apartment, living-room flooring material, age of house/apartment building, house renovation/interior completion after becoming pregnant, and number of years living in the current place of residence, with 19 regions set as a random effect.

Table S1. Mean and SD values, β s and 95% CIs for the score of each developmental area in the ASQ-3 according to the use or nonuse of air purifiers.

	M	SD	Crude β [95% CI]	Model1 β [95% CI]	Model2 β [95% CI]
6 months					
Communication					
AP use	46.6	± 9.1	-0.06 [-0.19, 0.06]	0.10 [-0.02, 0.23]	0.10 [-0.03, 0.22]
AP nonuse	46.7	± 9.1	Reference	Reference	Reference
Gross motor					
AP use	33.8	± 13.0	0.37 [0.19, 0.55]	0.32 [0.14, 0.50]	0.32 [0.14, 0.50]
AP nonuse	33.4	± 13.2	Reference	Reference	Reference
Fine motor					
AP use	41.1	± 14.4	0.36 [0.16, 0.56]	0.34 [0.15, 0.54]	0.32 [0.12, 0.52]
AP nonuse	40.7	± 14.5	Reference	Reference	Reference
Problem solving					
AP use	44.5	± 12.7	0.49 [0.31, 0.67]	0.54 [0.36, 0.72]	0.53 [0.35, 0.71]
AP nonuse	43.9	± 13.2	Reference	Reference	Reference
Personal-social					
AP use	34.7	± 15.5	0.62 [0.41, 0.84]	0.70 [0.48, 0.91]	0.68 [0.46, 0.90]
AP nonuse	34.1	± 15.7	Reference	Reference	Reference
12 months					
Communication					
AP use	38.4	± 13.8	1.10 [0.91, 1.28]	1.04 [0.85, 1.23]	1.03 [0.84, 1.22]
AP nonuse	37.4	± 14.0	Reference	Reference	Reference
Gross motor					
AP use	43.4	± 18.6	0.76 [0.51, 1.01]	0.68 [0.43, 0.93]	0.67 [0.42, 0.92]
AP nonuse	42.6	± 18.4	Reference	Reference	Reference
Fine motor					
AP use	48.8	± 11.8	0.76 [0.59, 0.93]	0.71 [0.54, 0.88]	0.70 [0.53, 0.87]
AP nonuse	48.0	± 12.4	Reference	Reference	Reference
Problem solving					
AP use	43.1	± 14.0	1.33 [1.13, 1.52]	0.93 [0.73, 1.12]	0.91 [0.71, 1.10]
AP nonuse	41.8	± 14.6	Reference	Reference	Reference
Personal-social					
AP use	37.8	± 15.2	1.04 [0.84, 1.25]	1.06 [0.85, 1.27]	1.05 [0.84, 1.25]
AP nonuse	36.8	± 15.3	Reference	Reference	Reference

β , delta difference; CI, confidence interval; AP, air purifier; ASQ-3, Ages & Stages Questionnaire, Third edition

Based on imputed data for the 82,441 infants in this study.

Boldface indicates statistical significance at the level of 5%.

The total score for each area ranges from 0 to 60 points (the higher, the better).

Crude = crude model only, with 19 regions set as a random effect.

Model 1 = partial model adjusted for maternal age, parity, smoking status, passive smoking status, folic acid intake, marital status, highest educational level, annual household income, type of residence, number of rooms in the house/apartment, materials covering the floor of the living room, and age of house/apartment building, with the region set as a random effect.

Model 2 = full model adjusted for all the covariates in model 1: body mass index, alcohol intake, number of hours spent outdoors, physical activity, employment status, high-rise living, house renovation/interior completion after becoming pregnant, and number of years living in the current place of residence.

SAS code for multiple imputation (MI) and generalized linear mixed models (GLMMs) for MI.

```
/* MI */
```

```
proc mi nimpute=24 data=ageof01_196_all seed=6342 out=outmi;
```

```
class      mt1_marriage_status
           mt2_house_type
           unit_rc_no
           c_sex
           baby_anomaly
           mt2_work_ver2
           mt2_smoking_ver2
           mt2_p_smo_freq
           mt2_activity_ver2
           mt2_alcohol_ver2
           mt2_income_ver2
           mt2_school_ver2
           mt2_school_hus_ver2
           DrT1_parity_ver2
           dr0m_preg_compli
           mt2_house_age
           mt2_ext_carpe
           mt2_living_floor
           mt2_air_purifi
           m1m_lactate
```

```
;
```

```
fcs reg (  m_height
           m_weightb
           MT2_m_age
           mt2_energy
           mt2_fish
           mt2_folicA_mg
           mt2_income_n
           birth_weeks
           MT1_metsmin_av_m
           MT2_metsmin_av_m
           mt2_outdoor_time_2
           mt2_live_year
           mt2_rooms
           C6m_ASQ_aComu C6m_ASQ_bGM C6m_ASQ_cFM C6m_ASQ_dProblem C6m_ASQ_ePersonal
           C1y_ASQ_aComu C1y_ASQ_bGM C1y_ASQ_cFM C1y_ASQ_dProblem C1y_ASQ_ePersonal
)
```

```
discrim ( mt1_marriage_status
           mt2_house_type
           unit_rc_no
           c_sex
           baby_anomaly
           mt2_smoking_ver2
           mt2_activity_ver2
           mt2_alcohol_ver2
           mt2_ext_carpe
           dr0m_preg_compli
           mt2_air_purifi
           mt2_living_floor
           / classeffects=include
)
```

```

logistic ( m1m_lactate
           mt2_work_ver2
           mt2_p_smo_freq
           mt2_income_ver2
           mt2_school_ver2
           mt2_school_hus_ver2
           mt2_house_age
           DrT1_parity_ver2
           / LIKELIHOOD=AUGMENT
);

var

/* continuous*/
    m_height
    m_weightb
    MT2_m_age
    mt2_energy
    mt2_fish
    mt2_folicA_mg
    mt2_income_n
    birth_weeks
    MT1_metsmin_av_m
    MT2_metsmin_av_m
    mt2_outdoor_time_2
    mt2_live_year
    mt2_rooms
    C6m_ASQ_aComu C6m_ASQ_bGM C6m_ASQ_cFM C6m_ASQ_dProblem C6m_ASQ_ePersonal
    C1y_ASQ_aComu C1y_ASQ_bGM C1y_ASQ_cFM C1y_ASQ_dProblem C1y_ASQ_ePersonal

/* categorical */
    mt1_marriage_status
    mt2_house_type
    unit_rc_no
    c_sex
    baby_anomaly
    mt2_smoking_ver2
    mt2_activity_ver2
    mt2_alcohol_ver2
    dr0m_preg_compli
    mt2_ext_carpe
    mt2_living_floor
    mt2_air_purifi
    m1m_lactate

/*order*/
    mt2_work_ver2
    mt2_p_smo_freq
    mt2_school_ver2
    mt2_school_hus_ver2
    mt2_income_ver2
    mt2_house_age
    DrT1_parity_ver2
;
run;

```

```
/* GLMMs for MI */
```

```
/* 1st part: GLMMs for each imputed dataset*/
```

```
ods select none;
```

```
proc glimmix data=outmi method=quad;
```

```
class mt2_house_type(ref="1");
```

```
class mt2_house_age(ref="1");
```

```
class mt2_live_year_ver2(ref="0");
```

```
class mt2_kousou(ref="0");
```

```
class mt2_rooms_ver2(ref="2");
```

```
class mt2_ext_carpe(ref="2");
```

```
class mt2_air_purifi(ref="2");
```

```
class mt2_living_floor(ref="1");
```

```
class mt2_income_ver2(ref="1");
```

```
class mt2_school_ver2(ref="1");
```

```
class mt1_marriage_status(ref="1");
```

```
class mt1_BMI_ver2(ref="2");
```

```
class mt2_smoking_ver2(ref="1");
```

```
class mt2_p_smo_freq(ref="1");
```

```
class mt2_activity_ver2(ref="0");
```

```
class mt2_alcohol_ver2(ref="1");
```

```
class drt1_parity_ver2(ref="0");
```

```
class mt2_work_ver2(ref="0");
```

```
class mt2_m_age_ver2(ref="1");
```

```
class qn_mt2_folicA_mg(ref="0");
```

```
class mt2_out_t_ver2(ref="0");
```

```
class unit_rc_no;
```

```
model c6m_comm_case =
```

```
/*model c6m_gm_case =*/
```

```
/*model c6m_fm_case =*/
```

```
/*model c6m_prob_case =*/
```

```
/*model c6m_pers_case =*/
```

```
/*model c6m_asq_total/N_asq=*/          /* N_asq = 5;*/
```

```
/*model c1y_gm_case =*/
```

```
/*model c1y_fm_case =*/
```

```
/*model c1y_prob_case =*/
```

```
/*model c1y_pers_case =*/
```

```
/*model c1y_asq_total/N_asq=*/
```

```
mt2_house_type
```

```
mt2_house_age
```

```
mt2_live_year_ver2
```

```
mt2_kousou
```

```
mt2_rooms_ver2
```

```
mt2_ext_carpe
```

```
mt2_air_purifi
```

```
mt2_living_floor
```

```
mt2_income_ver2
```

```
mt2_school_ver2
```

```
mt1_marriage_status
```

```

mt1_BMI_ver2
mt2_smoking_ver2
mt2_p_smo_freq
mt2_activity_ver2
mt2_alcohol_ver2/
drt1_parity_ver2
mt2_work_ver2
MT2_m_age_ver2

qn_mt2_folicA_mg
mt2_out_t_ver2

/ dist = binomial solution covb oddsratio ddfm = bw;
random intercept / subject = unit_rc_no;

by _Imputation_;
ods output ParameterEstimates=gparms;
run;
ods select all;

```

/* 2nd part: combining estimates using Rubin's rule */

```

proc mianalyze parms=gparms;
class mt2_house_type;
class mt2_house_age;
class mt2_live_year_ver2;
class mt2_kousou;
class mt2_rooms_ver2;
class mt2_ext_carpe;

class mt2_air_purifi;

class mt2_living_floor;
class mt2_income_ver2;
class mt2_school_ver2;
class mt1_marriage_status;
class mt1_BMI_ver2;
class mt2_smoking_ver2;
class mt2_p_smo_freq;
class mt2_activity_ver2;
class mt2_alcohol_ver2;
class drt1_parity_ver2;
class mt2_work_ver2;
class mt2_m_age_ver2;
class qn_mt2_folicA_mg;
class mt2_out_t_ver2;

```

modeleffects Intercept

```

mt2_house_type
mt2_house_age
mt2_live_year_ver2
mt2_kousou
mt2_rooms_ver2
mt2_ext_carpe

```

mt2_air_purifi

mt2_living_floor

mt2_income_ver2

mt2_school_ver2

mt1_marriage_status

mt1_BMI_ver2

mt2_smoking_ver2

mt2_p_smo_freq

mt2_activity_ver2

mt2_alcohol_ver2

drt1_parity_ver2

mt2_work_ver2

MT2_m_age_ver2

qn_mt2_folicA_mg

mt2_out_t_ver2

;

run;