ONLINE SUPPLEMENTAL MATERIAL for *International Archives of Occupational and Environmental Health* Article:

**Explorations of the effects of classroom humidity levels on teachers’ respiratory symptoms**

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SUPPLEMENTAL MATERIALS: EQUATIONS

*Equation for Generalized Estimating Equation (GEE) models using the modified Poisson regression approach for correlated binary data [*[*1*](#_ENREF_1)*].*

*log (µit)=*$ \hat{β}$*0+*$\hat{β}$*nxit (n)* (*Equation S1*)

where *µit* =average risk of having outcome=1, *x*=observed exposure/covariate, *n*= number of covariates, *t*=time (days), *i*=individual.

**Conversion from temperature and relative humidity to absolute humidity**

*Conversion from temperature (oC) to saturation vapor pressure (kPa) [*[*2*](#_ENREF_2)*]*

*es=*0.6108 exp $[\frac{17.27 T}{T+237.3}]$, where *es* is saturation vapor pressure (kPa) and *T* is temperature (oC). *(Equation S2)*

*Unit conversion of saturation vapor pressure from kPa to inHg* (This step is optional because you will be converting back to kPa in Equation 5.)

*es* (inHg)*=* 0.295300 *es* (kPa) *(Equation S3)*

(<http://www.srh.noaa.gov/images/epz/wxcalc/pressureConversion.pdf>)

*Conversion from saturation vapor pressure values (inHg) to vapor pressure (inHg) [*[*3*](#_ENREF_3)*]*

*ev =*$ \frac{U}{100}$ *es*, where *es* is saturation vapor pressure (inHg), *ev* is vapor pressure (inHg), and U is relative humidity (%) *(Equation S4)*

Reverse Equation 3 to convert back to kPa.

*Conversion from vapor pressure (kPa) to absolute humidity (g/m3) [*[*2*](#_ENREF_2)*]*

χ =$\frac{2165 e\_{v}}{T+273.16}$, where *ev* is vapor pressure (kPa), *T* is temperature (oC), and χ is absolute humidity (g/m3) *(Equation S5)*

SUPPLEMENTAL MATERIALS: TABLES

Table S1. Associations between UNADJUSTED Cumulative CLASSROOM Humidity Exposure and Respiratory symptoms of teachers on the seventh day a

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Symptoms** | **After 5 g/m3 increase in cumulative average AH**  | **After 5 days of <30% vs.** **30-50% RH** | **After 5 days of >50% vs.** **30-50% RH** | **After 5 days of >60% vs.** **30-60% RH** |
|  | RR (95% CI) | RR (95% CI) | RR (95% CI) | RR (95% CI) |
| Asthma-like b | 0.88 (0.48, 1.63) | 1.15 (0.75, 1.77) | 1.21 (0.82, 1.77) | 0.93 (0.39, 2.19) |
| Cold/allergy c | 0.83 (0.64, 1.07) | 1.11 (0.93, 1.33) | 1.05 (0.85, 1.28) | 0.83 (0.56, 1.21) |

AH=Classroom average daily absolute humidity. CI=Confidence interval. RH=Classroom average daily relative humidity. RR=Relative risk.

a Results were estimated using a modified Poisson regression approach for correlated binary data, clustered by participant (i=122) with an autoregressive correlation matrix. Exposure to classroom was assessed using cumulative presence in school on the previous 7 days, regardless of whether the teacher was present on that day. b Asthma-like symptom models were adjusted for continuous outdoor temperature (OC). c No covariates met the criteria for inclusion in the cold/ allergy models.

SUPPLEMENTAL MATERIALS: SURVEYS

SURVEY S1. WEEKLY HEALTH DIARY-REGULAR

Q1 What Is Your Study ID Number? (Answer is required) If you do not remember your ID number, please contact Kim Gaetz at kim\_gaetz@unc.edu.

Q2 Please answer the following questions for each day of the work week.

|  |  |  |  |
| --- | --- | --- | --- |
|  | How long were you in your school each day? | Were you absent this day because you were sick? | Did you leave early this day because you were sick? |
|  | Number of Hours | Yes | No | Yes | No |
| Monday (4/4) |  |  |  |  |  |
| Tuesday (4/5) |  |  |  |  |  |
| Wednesday (4/6) |  |  |  |  |  |
| Thursday (4/7) |  |  |  |  |  |
| Friday (4/8) |  |  |  |  |  |

\*NOTE: Please fill in a number for every day. For days in which you did not enter your school building, write "0." Please round to the nearest half hour. (Ex: 7.5)

Q3 Please check off any days when you had:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Mon. (4/4) | Tues. (4/5) | Wed. (4/6) | Thurs. (4/7) | Fri. (4/8) |
| Carpool or bus duty |  |  |  |  |  |
| Recess duty |  |  |  |  |  |
| Cafeteria duty |  |  |  |  |  |

Q4 Please check off any days when you:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Mon. (4/4) | Tues. (4/5) | Wed. (4/6) | Thurs. (4/7) | Fri. (4/8) |
| Opened the windows or outside doors in your classroom |  |  |  |  |  |
| Used a dehumidifier in your classroom (To remove moisture from the air) |  |  |  |  |  |
| Used a humidifier in your classroom (To add moisture to the air) |  |  |  |  |  |
| Used an air freshener in your classroom |  |  |  |  |  |

Q5 What type of air freshener was it? (Please write brand and type-- ex: spray, disc, adjustable cone, plug-in, oil, reed diffuser)

Q6 Did you take any allergy medications this week?

* Yes, I took them every day.
* Yes, but not everyday.
* No

Answer If AllergyMeds Yes, but not every day. Is Selected

Q7 Please check off any days when you took allergy medications:

* Sun. (4/3)
* Mon. (4/4)
* Tues. (4/5)
* Wed. (4/6)
* Thurs. (4/7)
* Fri. (4/8)
* Sat. (4/9)

Q8 Did you have any skin problems this week?

* Yes
* No

Answer If SkinProblems Yes Is Selected

Q9 Check the box for each day(s) of the week when you experienced each symptom. If “other,” please write in the symptom in the space provided.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sun. (4/3) | Mon. (4/4) | Tues (4/5) | Wed. (4/6) | Thurs. (4/7) | Fri. (4/8) | Sat. (4/9) |
| Rash |  |  |  |  |  |  |  |
| Itchy Skin |  |  |  |  |  |  |  |
| Dry Skin |  |  |  |  |  |  |  |
| Other: (please specify) |  |  |  |  |  |  |  |

Q10 Did you have any breathing problems this week?

* Yes
* No

Answer If BreathingProbs Yes Is Selected

Q11 Check the box for each day(s) of the week when you experienced each symptom. If “other,” please write in the symptom in the space provided.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sun. (4/3) | Mon. (4/4) | Tues. (4/5) | Wed. (4/6) | Thurs. (4/7) | Fri. (4/8) | Sat. (4/9) |
| Wheezing |  |  |  |  |  |  |  |
| Chest Pain |  |  |  |  |  |  |  |
| Tightness in chest |  |  |  |  |  |  |  |
| Shortness of Breath |  |  |  |  |  |  |  |
| Other: (please specify) |  |  |  |  |  |  |  |

Q12 Did you have any cold/flu/sinus/allergy symptoms this week?

* Yes
* No

Answer If ColdFluSinusAllergySymp Yes Is Selected

Q13 Check the box for each day(s) of the week when you experienced each symptom. If “other,” please write in the symptom in the space provided.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sun. (4/3) | Mon. (4/4) | Tues. (4/5) | Wed. (4/6) | Thurs. (4/7) | Fri. (4/8) | Sat. (4/9) |
| Body aches (not muscle strain) |  |  |  |  |  |  |  |
| Chills |  |  |  |  |  |  |  |
| Stuffy nose |  |  |  |  |  |  |  |
| Runny nose |  |  |  |  |  |  |  |
| Sneezing |  |  |  |  |  |  |  |
| Itchy eyes |  |  |  |  |  |  |  |
| Itchy, scratchy throat |  |  |  |  |  |  |  |
| Sore throat |  |  |  |  |  |  |  |
| Fever (100F or more) |  |  |  |  |  |  |  |
| Productive cough (phlegm) |  |  |  |  |  |  |  |
| Other: (please specify) |  |  |  |  |  |  |  |

Q14 Did you have any stomach or digestive problems this week?

* Yes
* No

Answer If StomachProbs Yes Is Selected

Q16 Check the box for each day(s) of the week when you experienced each symptom. If “other,” please write in the symptom in the space provided.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sun. (4/3) | Mon. (4/4) | Tues. (4/5) | Wed. (4/6) | Thurs. (4/7) | Fri. (4/8) | Sat. (4/9) |
| Nausea |  |  |  |  |  |  |  |
| Stomach pain |  |  |  |  |  |  |  |
| Vomiting |  |  |  |  |  |  |  |
| Diarrhea |  |  |  |  |  |  |  |
| Other: (please specify) |  |  |  |  |  |  |  |

Q17 Did you have any other health problems this week?

* Yes
* No

Answer If HealthProbs Yes Is Selected

Q18 Check the box for each day(s) of the week when you experienced each symptom. If “other,” please write in the symptom in the space provided.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sun. (4/3) | Mon. (4/4) | Tues. (4/5) | Wed. (4/6) | Thurs. (4/7) | Fri. (4/8) | Sat. (4/9) |
| Headache |  |  |  |  |  |  |  |
| Fatigue/ Extremely tired |  |  |  |  |  |  |  |
| Dry cough |  |  |  |  |  |  |  |
| Other: (please specify) |  |  |  |  |  |  |  |
| Other: (please specify) |  |  |  |  |  |  |  |
| Other: (please specify) |  |  |  |  |  |  |  |

Q19  If you reported any health issues, did you notice any of these symptoms getting worse in particular areas or rooms of the school?

* Yes
* No
* No health issues

Answer If AreaSpecSymp Yes Is Selected

Q20 Please explain.

Q21 Did a doctor or other health professional diagnose you with asthma this week?

* Yes
* No

Q22 Please write date of diagnosis. (MM/DD/YYYY)

Q23 Please list any new medications you took this week. (Optional):

Q24 Please write any additional comments here. (Optional)

SURVEY S2. WEEKLY HEALTH DIARY-ADDITIONAL QUESTIONS FOR ASTHMATIC PARTICIPANTS

Q8 Did you use your rescue inhaler or nebulizer this week (Albuterol, Ventolin®, Proventil®, Maxair® or Primatene Mist®)?

* Yes, I used it every day.
* Yes, but not every day.
* No.

Answer If RescueInhal Yes, but not every day. Is Selected

Q9 Please check off any days when you used your rescue inhaler or nebulizer:

* Sun. (4/10)
* Mon. (4/11)
* Tues. (4/12)
* Wed. (4/13)
* Thurs. (4/14)
* Fri. (4/15)
* Sat. (4/16)

Q10 Did you use a controller inhaler this week? (ex: Advair ®, Flovent®, etc)

* Yes, I used it every day.
* Yes, but not every day.
* No.

Answer If ControlInhal Yes, but not every day. Is Selected

Q11 Please check off any days when you used your controller inhaler or nebulizer:

* Sun. (4/10)
* Mon. (4/11)
* Tues. (4/12)
* Wed. (4/13)
* Thurs. (4/14)
* Fri. (4/15)
* Sat. (4/16)

Q24 During the past week, how often did you feel concerned about your asthma?

* All of the time
* Most of the time
* Some of the time
* A little of the time
* None of the time

REFERENCES

1 Zou G, Donner A. Extension of the modified Poisson regression model to prospective studies with correlated binary data. *Statistical methods in medical research* 2013;**22**:661-70.

2 Snyder RL. Humidity Conversion. Davis: University of California, Davis, Biometeorology Program 2005.

3 Parish OO, Putnam TW. Equations for the Determination of Humidity from Dewpoint and Psychrometric Data. Washington, DC: National Aeronautics and Space Administration 1977.