

Background & Objectives

Background:

- 1) Most studies have examined extreme heat
- 2) However, few studies have examined the effects of winter factor

Knowledge Gaps:

- 1) Lack of studies on associations between individual winter factor on overall AD
- 2) Transitional months investigation are limited and neglected.
- 3) No studies on joint and interactive effects.

Objectives:

- (1) To investigate individual winter weather factors on overall and specific AD.
- (2) To examine whether the associations vary by season and socioeconomic status.
- (3) To evaluate the joint and interaction effects

Methodology

Study design:

Time-stratified case-crossover study by cumulative lags from 0 to 6.

Exposure data source:

- 1) NYS mesonet is a weather monitoring system consist of 126 stations evenly distributed across the state

Definition:

- 1) Daily meteorological data from 2017-2022.
- 2) We further calculated and created a binary variable for:
 - a) Wind chill temperature ($^{\circ}\text{F}$) ($\leq -10^{\circ}\text{F}$ vs. $> -10^{\circ}\text{F}$);
 - b) Pressure was defined as ≤ 100.8 kPa.
 - c) Freezing rain was defined as precipitation (> 0 mm) when the ambient temperature was $\leq 0^{\circ}\text{C}$.
 - d) Snow depth (units) were modeled per interquartile range increase (IQR).

Outcome data source:

- 1) Outpatient principal diagnosis matching AD and its subtypes were obtained from New York Statewide Planning and Research Cooperative System (SPARCS), 2017-2022 using the ICD-10.

Exposure Definition:

- 1) Overall AD including Rheumatologic & vasculitis, Gastrointestinal, endocrine, renal, skin and hematologic system.

Statistical methods:

- 1) Conditional logistic regression while controlling for PM2.5 and time-varying variables
- 2) We then evaluated the Joint effects and potential interaction the multiplicative and additive scales.
- 3) Stratified by months, socioeconomic status and subtypes.

Results

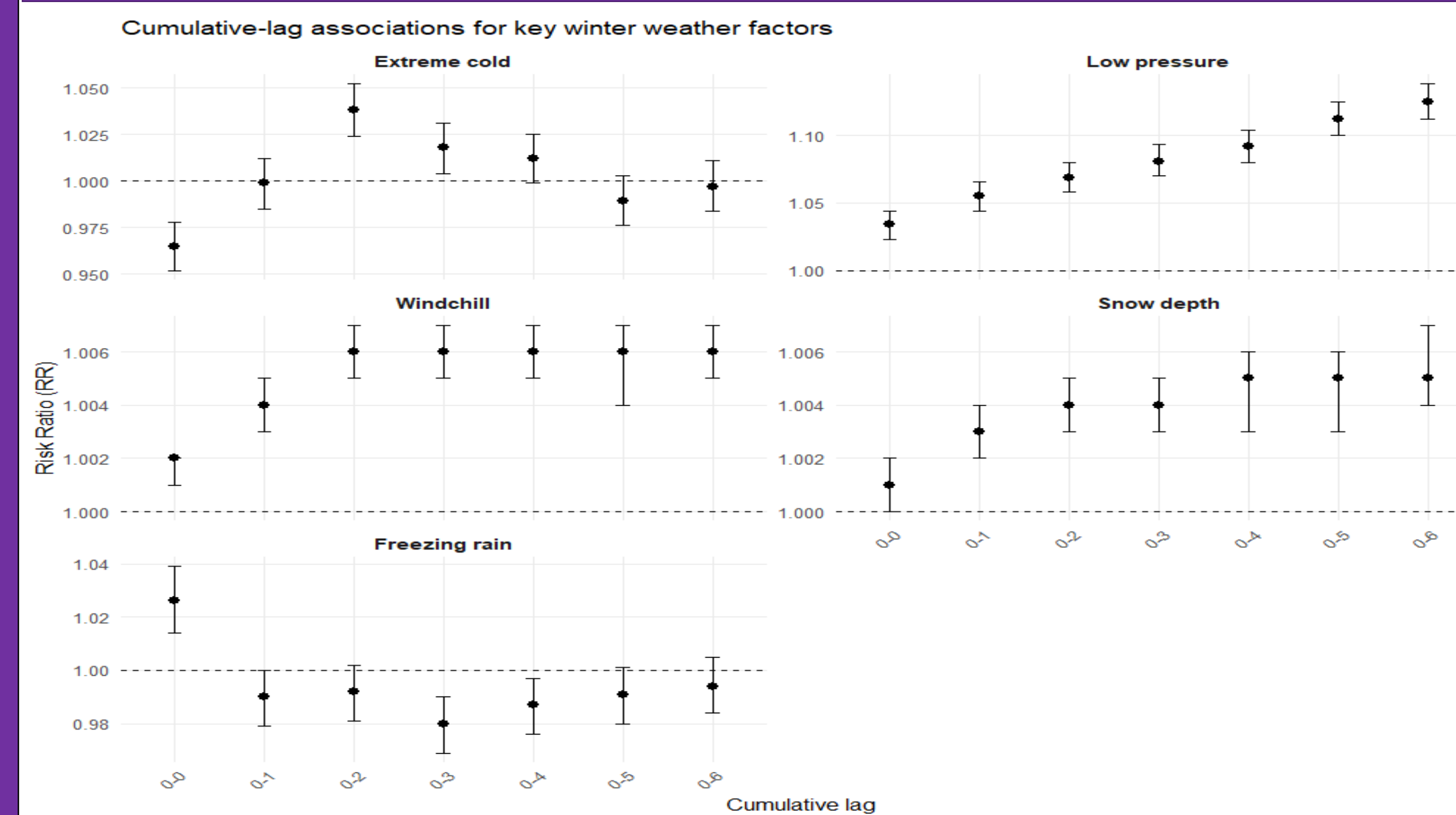


Table 1. Risk ratio for extreme cold, windchill, air pressure, snow depth and freezing rain on autoimmune diseases during winter season from 2017 to 2022

All individual were positively associated with AD, with the strongest association observed in low air pressure.

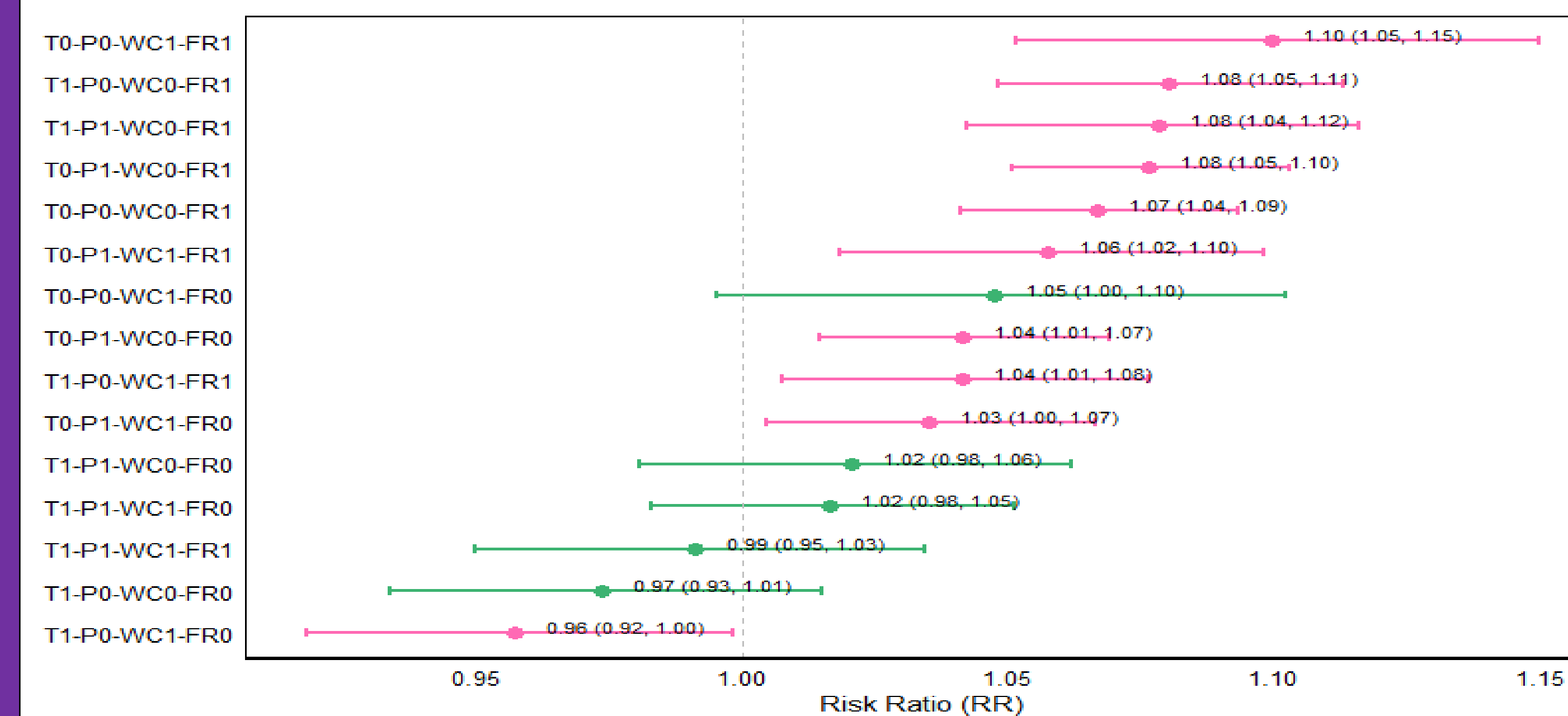


Figure 2. Joint effects risk for extreme cold (T1), windchill (WC1), low pressure (P1), and freezing rain (FR1) for autoimmune diseases

Table 1. effect modification on the additive and multiplicative scale

Modifiers	Extreme cold			RERI	AP	SI	Multiplicative P-value
	Extreme cold =1 and modifier=1	Extreme cold=1 and modifier=0	Extreme cold = 0 and modifier=1				
Low	1.095 (1.075, 1.116)	1.024 (1.004, 1.044)	1.068 (1.057, 1.079)	0.003 (-0.021, 0.028)	0.003 (-0.019, 0.025)	1.036 (0.797, 1.347)	0
Pressure	0.972 (0.955, 0.988)	1.016 (0.999, 1.033)	0.981 (0.966, 0.996)	-0.025 (-0.051, -0.000)	-0.026 (-0.052, -0.000)	9.655 (0.004, 24196.169)	
Windchill	1.038 (1.019, 1.057)	1.019 (1.002, 1.037)	1.002 (0.993, 1.012)	0.017 (-0.007, 0.041)	0.016 (-0.007, 0.039)	1.795 (0.670, 4.808)	0.0001
Snow depth	1.070 (1.041, 1.100)	1.015 (1.001, 1.030)	1.006 (0.996, 1.016)	0.049 (0.017, 0.080)	0.045 (0.017, 0.074)	3.269 (1.375, 7.771)	
Rain duration	1.045 (1.007, 1.084)	1.021 (1.007, 1.036)	0.973 (0.963, 0.983)	0.051 (0.011, 0.090)	0.048 (0.012, 0.085)		0.0207
RH	1.043 (1.006, 1.082)	1.015 (1.001, 1.029)	0.970 (0.961, 0.978)	0.059 (0.020, 0.097)	0.056 (0.021, 0.092)		
PM2.5							0.0209

The strongest multiplicative interaction was observed between extreme cold and low-pressure conditions while additive interaction showed the strongest effects in rain duration

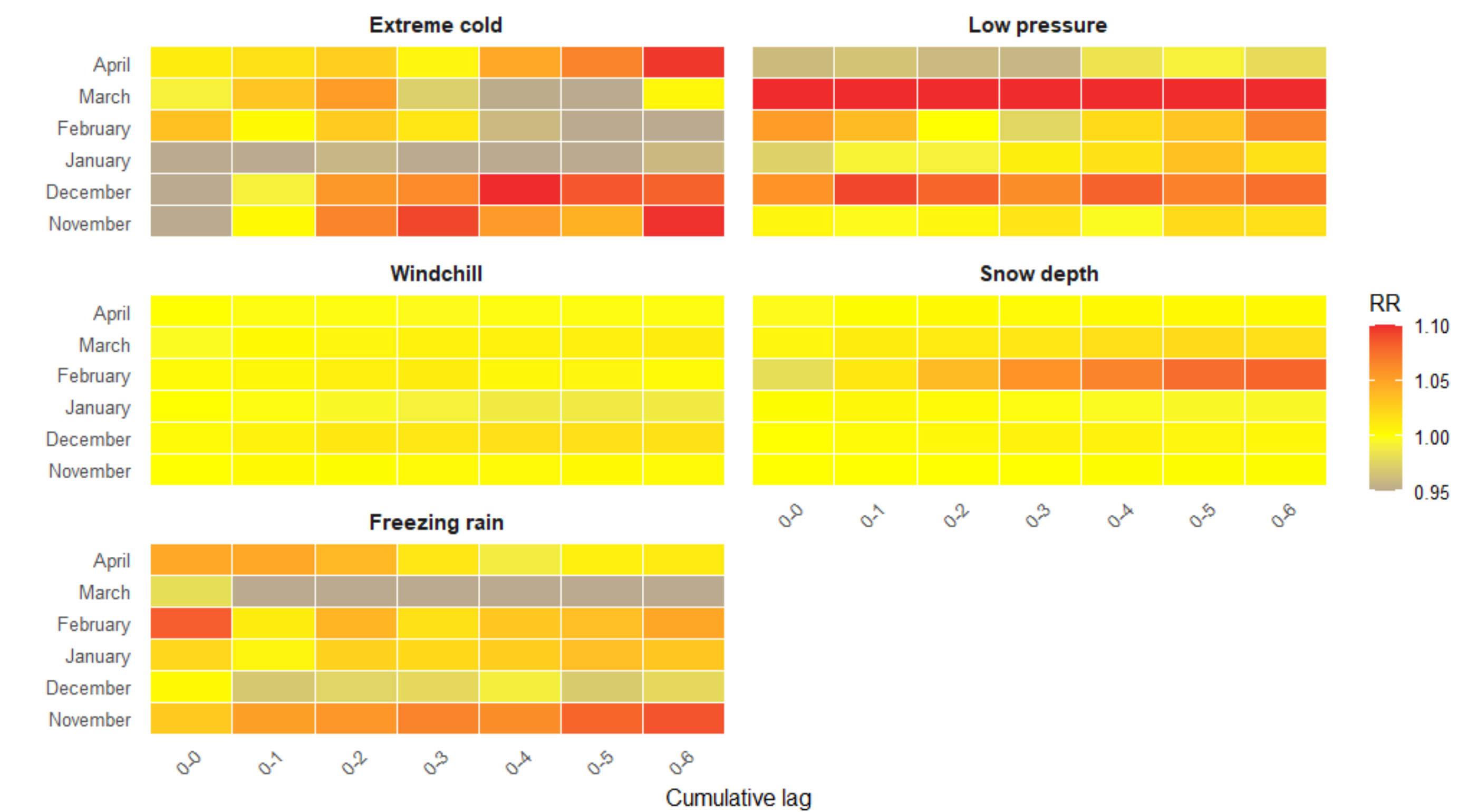
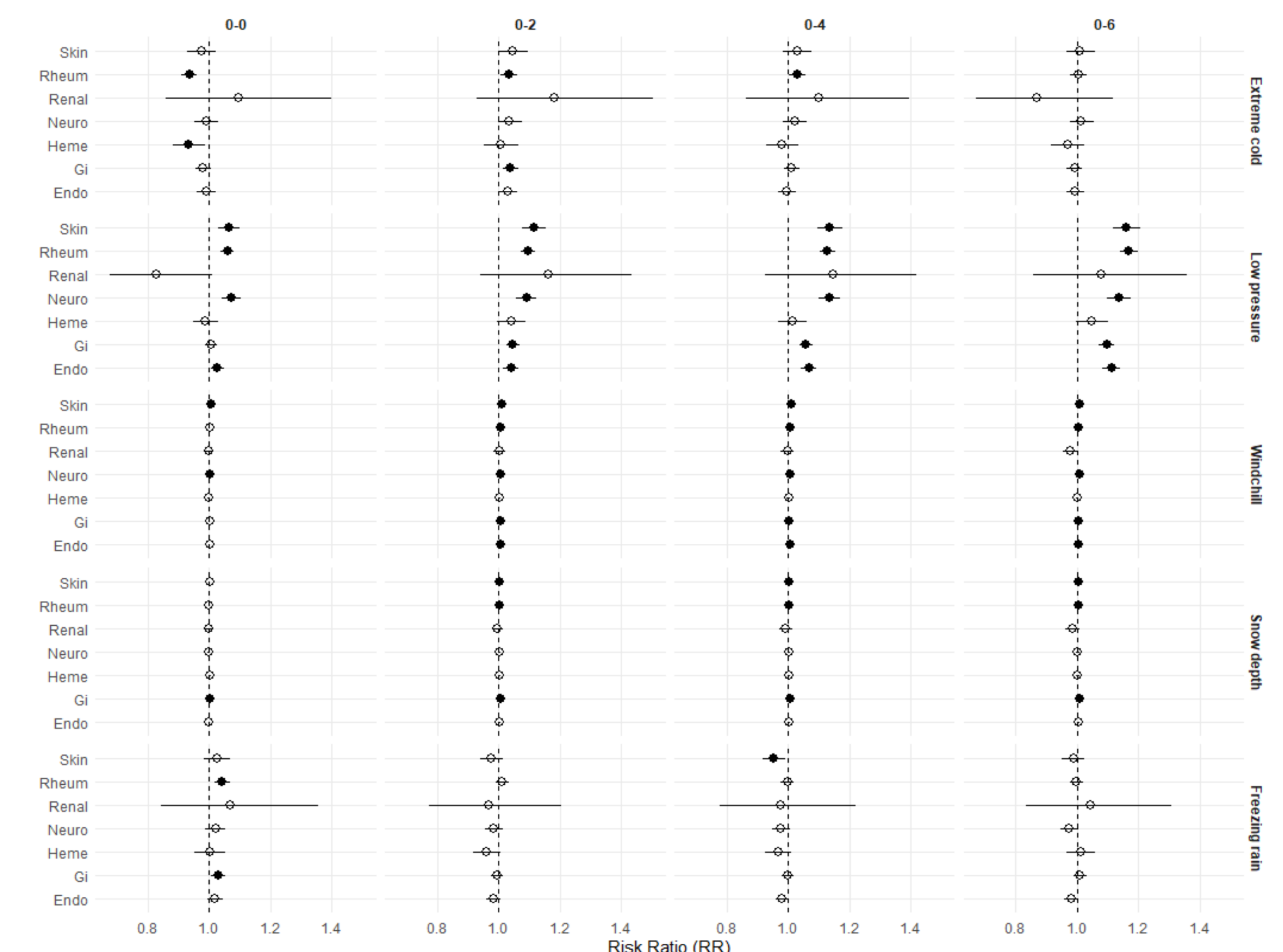


Figure 3. Risk ratio for winter factors on autoimmune diseases by month, New York State, 2017-2022, by cumulative lags.

Transitional months of march and November illustrated the highest risk compared to the winter months



We found immediate and consistently effects of weather factors for subtypes, specifically rheumatologic showed the highest risk

Conclusion

- 1)All individual winter factors increased risk for AD and subtypes.
- 2)Joint effects were stronger than individual effects.
- 3)Transitional months showed the highest risk compared to winter months.