I. Case Study Individual Write-up #6 – Lizette Romano

Question: 1. You've been asked to assist in the design of a case-control study to assess individual- and area-level risk/protective factors associated with mortality during a recent heatwave in the Netherlands. The analysis will use data collected using a questionnaire survey, along with available data from government sources.

1a. **Question 1a. How will you identify cases and controls? Include precise definitions of who would be defined as a case and who would be eligible as a control.**

Cases would be defined as people who died during the recent heatwave in the Netherlands. Cases could be identified using past medical records where the documented death is related to heat. Cases would need to be from the time span that the most recent heatwave took place. Controls would be identified as people who experienced the recent heatwave in the Netherlands but are still alive. Controls could be eligible based on geographic areas that the heatwave struck, medical records of people who visited the emergency room for a heat-related illness, and location proximity to the identified cases. Location proximity and identifying controls with similar characteristics as the cases could help with matching.

1b. **Question 1b. Drawing from class discussions and materials, identify three domains of risk/protective factors that you would want to assess in the questionnaire? At least one of these must pertain to individual-level risk/protective factors and at least one must pertain to area-level factors. Give an example of two potential risk/protective factors within each of the three domains. For each risk/protective factor, explain what you expect the results of your analysis to show and why.**

Three domains of risk/protective factors I would assess are socioeconomic, demographic, and environmental. I would assess individual-level factors under the socioeconomic domain, individual-level factors under the demographic domain, and area-level factors under the environment domain. A potential risk factor under the socioeconomic domain is having to work at an outdoor job. On the other hand, a protective factor under the socioeconomic domain is having a working air conditioner. A potential risk factor under the demographic domain is being a female. One potential protective factor under the demographic domain is being under 65 years old. A potential risk factor under the environment domain is living in an area that has poor air quality. Conversely, one potential protective factor is living in an area with tree cover and shade.

I would expect the results of the analysis to show that controls had more of or at least some of the protective factors and that cases had more risk factors. It would be expected that the protective factors gave controls a better chance of surviving the heat wave whereas risk factors with a lack of protective factors could have led to the mortality of cases. I would expect that working an outdoor labor job would increase the likelihood that someone would be a case because doing strenuous exercise in the heat could cause a person to not be able to regulate their body temperature.

Second, having a working air conditioner is the strongest protective factor during heat waves. I would expect that people who had a working air conditioner and were able to use it would be less likely to be a case and more likely to fall into the control group. I would also expect that people who used air conditioning would be less likely to have been recruited from hospital records. Next, I would expect that persons who identify as female would be more likely to be in the case group because they are expected to tend

to household duties such as cooking which may expose them to being around trapped heat indoors. I would expect that people who are younger than 65 years old would be more likely to be in the control group since younger people may be less socially isolated. Social isolation could lead to people not having anyone to check on them and could increase instances of mortality during heat waves.

Lastly, I would expect that people living in areas with poor air quality would be more likely to be in the cases group. People who live in areas with poor air quality have more respiratory problems, asthma, and may be at an increased risk of having cardiovascular disease. Overall, their respiratory functions may be worse which could lead to them having a harder time breathing with the extreme heat. On the other hand, people who live in areas with tree cover and shade might be more likely to be in the control group since they would have a place to cool down if walking outdoors. Trees also reduce the effects of the urban heat island so it may not be as hot in these areas.

2. **Question: Propose three program or policy recommendations for community-level interventions to minimize heat-related morbidity and mortality during future heat events.**

Three recommendations include increasing cooling centers in low-income areas, telehealth visits for vulnerable older populations, and increasing hydration stations and breaks for outdoor laborers. These recommendations would increase protective factors in low-income communities, people who are vulnerable, and people who may lack protections due to immigration status or work culture.

Increasing cooling centers in low-income areas would allow people who do not have access to air conditioning, those who live in hotter top floors of apartments, and

those who may be experiencing power outages to remain cool during heat waves. Some people may have air conditioning but may not be able to financially afford using it as they may have an inefficient appliance that uses a lot of energy. Cooling centers should be accompanied by accessible transportation options tailored to the community.

Second, telehealth visits from different providers for older populations such as seniors could ensure that seniors are regularly communicating with others during heat waves. Heat-related illness symptoms could be monitored, and seniors could receive care promptly. Regular telehealth visits could also improve the mental health of seniors who may sometimes feel social isolation by providing space for human interaction.

Lastly, enforcing shade and hydration breaks for outdoor workers could help workers regulate their body temperatures by cooling down and staying hydrated. Workers who are expected to meet quotas for production such as agricultural workers are less likely to take breaks since breaks would affect their income. Breaks should be paid, and a quota system should be reconsidered during heat waves. It would also be important to make sure that outdoor workers have access to water outside of work as strenuous work would require more water throughout the day.