Appendix G: Power calculations for Children's Cohort Feasibility Study

Power Computations to Estimate Sample for Children's Cohort. Power and sample size calculations were done to determine the sample size necessary to test the association between disease and (dichotomous) exposure, accounting for stratification by age. Three health outcomes chosen to calculate estimated sample sizes included asthma, coronary heart disease and all cancers. Results from published WTCHR studies on these outcomes were used a reference for estimates of association (Thomas et al, 2008; Brackbill et al, 2009; Jordan et al, 2011; Li et al, 2016).

Assumptions for all three sets of estimates:

- All subjects under 18 years old on 9/11/2001
- Age groups (currently) are 17-21, 22-26, 27-30, 31-34
- Power=80%
- α=0.05, one-sided test
- The proportion of the sample in each age group is 28%, 25%, 18%, 29% for both exposed and unexposed groups (categorized as above)

Asthma

Current age groups	Proportion in age group	Estimated prevalence	Estimated adjusted odds ratios (AOR)*	Sample necessary to detect AOR	
				Exposure	Non-exposure (comparison)
17-21	.28	4.4%	1.8	542	542
22-26	.25	4.4%	1.4	484	484
27-30	.18	4.4%	1.3	348	348
31-34	.29	4.5%	1.2	561	561
				Total	3868

*Thomas (2008) reported an adjusted Odds Ratio (AOR) for dust cloud and asthma among children ranging from 1.7 to 2.2. A conservative AOR of 1.8 was used for persons who would be younger than 21 at time of creation of Children's Cohort. Brackbill (2009) reported AOR ranging between 1.4 and 1.5 for intense dust cloud for adults older than 18. A conservative AOR was applied that declined with age for persons older than 21 at time of at time of possible creation of Children's Cohort.

Coronary Heart Disease

Current age groups	Proportion in age group	Estimated prevalence	Estimated Adjusted Hazard Ratios (AHR)*	Sample necessary to detect AHR	
				Exposure	Non-exposure (comparison)
17-21	.28	0.6%	1.7	970	970
22-26	.25	0.6%	1.7	866	866
27-30	.18	0.6%	1.7	623	623
31-34	.29	2.0%	1.7	1004	1004
				Total	6,926

*Jordan (2011) reported statistically significant adjusted hazard ratios for heart disease for different 9/11 exposures for adult men and women that ranged between 1.3 and 2.1.

Cancer

Current age groups	Proportion in age group	Estimated prevalence	Standardized Incidence Ratios (SIR)*	Sample necessary to detect SIR	
				Exposure	Non-exposure (comparison)
17-21	.28	0.05%	1.1	248065	248065
22-26	.25	0.07%	1.1	221487	221487
27-30	.18	0.07%	1.1	159470	159470
31-34	.29	0.10%	1.1	256924	256924
				Total	1,771,892

*The most recent report (Li et al, 2016) on cancer incidence and 9/11 exposure (for cancers diagnosed up to 2011) reported a significant Standardized Incidence Ratio (SIR) of 1.1 for non-rescue/recovery workers.

These sample estimates indicate that for cancer which has low prevalence in young adults that a large sample of almost 2 million and likely unachievable, would be required to detect an exposure/disease association. It would require a long time horizon to acquire sufficient number of cases as the cohort ages. Asthma and coronary heart disease, on the other hand, with an estimated total samples of about 3,800 and 6,900, respectively is likely achievable for a Children's Cohort. In addition, if the final Children's Cohort sample under-represents specific categories such as zone, age groups, or race/ethnic groups, the sample required as indicated by power computations would need to be increased proportionate to the representation bias.

References:

Brackbill RM, Hadler JL, DiGrande L, Ekenga CC, Farfel MR, Friedman S, Perlman SE, Stellman SD, Walker DJ, Wu D, Yu S, Thorpe L. , 2009, Asthma and posttraumatic stress symptoms 5 to 6 years following exposure to the World Trade Center Terrorist Attack. JAMA;302(5):502-516.

Jordan HT, Miller-Archie SA, Cone JE, Morabia A, Stellman SD. 2011, Heart disease among adults exposed to the September 11, 2001 World Trade Center disaster: Results from the World Trade Center Health Registry. Preventive Medicine;53:370-376.

Li J, Brackbill RM, Liao TS, Qiao B, Cone JE, Farfel MR, Hadler J, Kahn AR, Konty KJ, Stayner LT, Stellman SD, 2016,Ten-year cancer incidence in rescue/recovery workers and civilians exposed to the September 11, 2001 terrorist attacks on the World Trade Center. American Journal of Industrial Medicine:59:709-721.

Thomas PA, Brackbill R, Thalji L, DiGrande L, Campolucci S, Thorpe L, Henning K., 2008, Respiratory and other health effects reported in children exposed to the World Trade Center Disaster of 11 September 2001, Environmental Health Perspectives 116: 1383-1390.