

Prevalence of and Risk Factors for Hepatitis C Virus Infection in World Trade Center Responders

SUPPLEMENTARY MATERIALS

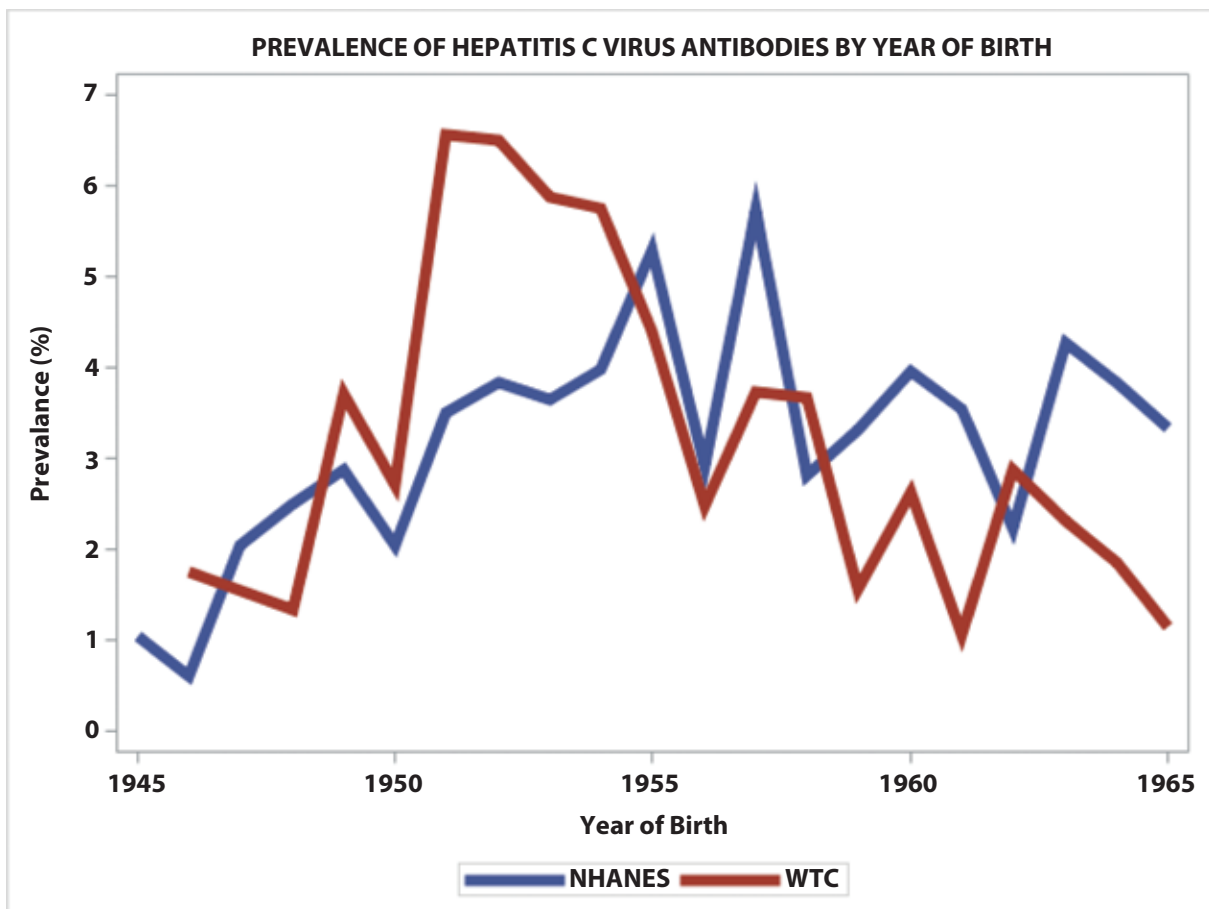


Figure S1. Prevalence of hepatitis C virus antibodies by year of birth in 3,871 members of the World Trade Center General Responder Cohort (recruited and tested from December 15, 2016 - July 12, 2018) and the US population based on National Health and Nutrition Examination Survey (NHANES) data from 2003 through 2012.

Table S1. Data sources for nested case-control study.

Data	World Trade Center General Responder Cohort (WTCGRC) Baseline Questionnaire	Hepatitis C Virus Risk Factor Questionnaire	Blood draw for hepatitis C virus antibodies
Time of data collection in relation to the World Trade Center General Responder Cohort Study	Baseline visit for WTCGRC (Visit 1)	Visit to for enrollment or monitoring WTCGRC (Visit 1 or higher)	
Date of data collection for the 2632 persons in current study	July 18, 2002 – May 8, 2018	December 15, 2016 – July 12, 2018 (The HCV Risk Factor Questionnaire and the blood draw were done on the same day)	
Study outcome – Hepatitis C Virus Antibody status			X
Main exposures			
Human remains	X		
Blood and bodily fluids	X		
Sewage	X		
A priori confounders (included in the final multivariable logistic regression models)			
Year of birth		X	
Traditional risk factors for HCV infection			
• Blood transfusion/organ transplant before July 1992		X	
• Receipt of clotting factor concentrate produced before 1987		X	
• Hemodialysis		X	
• Receipt of blood from an HCV-infected donor		X	
• Birth to an HCV-infected mother		X	
• History of HIV/AIDS		X	
• History of injecting drug use			
• Needle stick, sharps or mucosal exposure as a health care, emergency medical, or public safety worker		X	
Characteristics evaluated as possible confounders			
Demographics			
• Sex	X		
• Race	X		
• Ethnicity	X		
• Country of birth		X	
• Insurance status		X	

Data	World Trade Center General Responder Cohort (WTCGRC) Baseline Questionnaire	Hepatitis C Virus Risk Factor Questionnaire	Blood draw for hepatitis C virus antibodies
Activities at the WTC site			
• Year of enrollment in WTCGRC	X		
• Type of work at the WTC site	X		
• Use of protective gloves	X		
• Use of protective clothing	X		
• Seeking care for injury or illness	X		

Table S2. Association between participant activity at the World Trade Center site and hepatitis C virus (HCV) antibody status among of a subset of the World Trade Center General Responder Cohort, recruited and tested for HCV from December 15, 2016 - July 12, 2018 (N=2,632).

Activity (in order of questionnaire)	Total N	HCV Antibody+	HCV Antibody- †	P-value
		N=61 (%)	N=2571 (%)	
Department of Labor Codes				
Barge workers (53-5021.00)	3	1 (2)	2 (0.1)	0.07‡
Boiler makers (47-2011.00)	0	0	0	
Carpenters (47-2051.00)	21	1 (2)	20 (1)	0.39‡
Carpet, floor, and tile installers and finishers (47-2041.00)	0	0	0	
Construction and building inspectors (47-4011.00)	2	0	2 (0.1)	1.00‡
Construction equipment operators (47-2073.00)	2	0	2 (0.1)	1.00‡
Dock builders (47-2031.00)	3	0	3 (0.1)	1.00‡
Drywall installers, ceiling tile installers, and tapers (47-2081.00)	1	0	1 (0.04)	1.00‡
Electricians (47-2111.00)	25	1 (2)	24 (1)	0.45‡
Elevator installers and repairers (47-4021.00)	1	0	1 (0.04)	1.00‡
Engineers (structural/other, operating & (heavy) equipment operators coded together) (17-2199.00)	33	0	33 (1)	1.00‡
Equipment workers (49-2022.01)	5	0	5 (0.2)	1.00‡
Glaziers (47-2121.00)	1	0	1 (0.04)	1.00‡
Hazardous materials removal workers (47-4041.00)	6	0	6 (0.2)	1.00‡
Heating, air & refrigeration mechanics (49-9021.00)	5	1 (2)	4 (0.2)	0.11‡
Highway maintenance workers (47-4051.00)	4	1 (2)	3 (0.1)	0.09‡
Insulation workers (47-2131.00)	3	0	3 (0.1)	1.00‡
Ironworkers, structural and reinforcing iron and metal workers (47-2221.00)	77	2 (3)	75 (3)	0.70‡
Laborers (53-7062.00)	34	3 (5)	31 (1)	0.04‡
Landscapers & groundskeepers (37-3011.00)	0	0	0	
Masons: brick, block and stone (47-2021.00)	1	0	1 (0.04)	1.00‡
Masons: cement, concrete finishers, segmental pavers, and terrazzo workers (47-2031.00)	0	0	0	
Masons: plasterers and stucco (47-2161.00)	0	0	0	
Mechanics (49-3011.00)	17	0	17 (1)	1.00‡

Table S2 (Continued)

Activity (in order of questionnaire)	Total N	HCV	HCV	P-value
		Antibody+	Antibody- †	
Painters and paperhangers (47-2141.00)	0	0	0	
Paving, surfacing, & tamping workers (47-2071.00)	1	0	1 (0.04)	1.00‡
Pipe layers, plumbers, pipe fitters, and steam fitters (47-2151.00)	9	0	9 (0.4)	1.00‡
Roofers (47-2181.00)	0	0	0	
Sheet metal workers (47-2211.00)	5	0	5 (0.2)	1.00‡
Truck drivers (53-3032.00)	24	3 (5)	21 (1)	0.02‡
Military (55-0000)	2	0	2 (0.1)	1.00‡
World Trade Center Site Activities				
Body bag work	71	3 (5)	68 (3)	0.23‡
Bucket brigade	439	8 (13)	431 (17)	0.43§
Cable installation/repair/splicing (EXCLUDING work performed in manholes)	44	1 (2)	43 (2)	1.00‡
Cable installation/repair/splicing (INCLUDING work performed in manholes)	46	3 (5)	43 (2)	0.09‡
Canteen services	67	2 (3)	65 (3)	0.67‡
Counselor	16	0	16 (1)	1.00‡
Custodian	97	1 (2)	96 (4)	0.73‡
Dog handlers	1	0	1 (0.04)	1.00‡
Dust suppression	34	0	34 (1)	1.00‡
Emergency medical technician	16	1 (2)	15 (1)	0.32‡
Escorting	161	3 (5)	158 (6)	1.00‡
Excavation / Confined space work	38	0	38 (1)	1.00‡
Fire Fighter	20	0	20 (1)	1.00‡
Industrial Hygienist	4	0	4 (0.2)	1.00‡
Morgue work	98	1 (2)	97 (4)	0.73‡
Police Officer	344	0	344 (13)	<0.001‡
Perimeter security	520	2 (3)	518 (20)	<0.001‡
Sanitation workers	37	1 (2)	36 (1)	0.59‡
Search and rescue	423	9 (15)	414 (16)	0.86§
Sifting (EXCLUDING conveyer belt)	135	2 (3)	133 (5)	0.77‡
Sifting (INCLUDING conveyer belt)	192	2 (3)	190 (7)	0.32‡
Towing	7	0	7 (0.3)	1.00‡
Truck loading/unloading	69	2 (3)	67 (3)	0.68‡
Truck routing	16	1 (2)	15 (1)	0.32‡
Other	636	20 (33)	616 (24)	0.12§

HCV: hepatitis C virus

† Of the 2571 persons without HCV antibodies (controls), 21 (1%) did not provide any data about the type of activities they performed at the WTC site. The percentages presented here are percentages among the controls for whom there is data on activity at the WTC site.

‡ Analyzed using Fishers Exact test determined the association between participation in the listed activity vs. no participation in the listed activity and HCV infection.

§ Analyzed using Chi-Square Test determined the association between participation in the listed activity vs. no participation in the listed activity and HCV infection.

Table S3. Characteristics of World Trade Center (WTC) perimeter security workers from a subset of the WTC General Responder Cohort, recruited and tested for hepatitis C virus antibodies from December 15, 2016 – July 12, 2018 (N=520).

Characteristics	HCV Antibody+		HCV Antibody-		P-value
		N=2 (%)		N=518 (%)	
Demographics					
Sex					
	Male	1 (50)		415 (80)	.36*
	Female	1 (50)		103 (20)	
Time period of birth					
	1945 - 1949	0		16 (3)	.57*
	1950 - 1954	0		42 (8)	
	1955 - 1959	1 (50)		119 (23)	
	1960 - 1965	1 (50)		341 (66)	
Race					
	White	0		260 (50)	.11*
	Multi-Racial	1 (50)		98 (19)	
	Black	0		103 (20)	
	Asian	0		7 (1)	
	American Indian / Alaskan Native	0		1 (0.2)	
	Pacific Islander	0		0	
	Not answered	1 (50)		49 (9)	
Latino					
	Yes	2 (100)		144 (29)	.08*
	No	0		361 (71)	
Insurance status (N=496)					
	Medicaid	0		2 (0.4)	1.00*
	Medicare	0		39 (8)	
	No insurance	0		4 (1)	
	Private insurance	1 (100)		450 (91)	
Born in the United States (N=514)					
	Yes	1 (50)		432 (84)	.29*
	No	1 (50)		80 (16)	
Main Exposures					
Contact with human remains					
	Yes	1 (50)		255(49)	1.00*
	No	1 (50)		263 (51)	
Contact with blood and/or bodily fluids					
	Yes	1 (50)		158 (31)	.52*
	No	1 (50)		360 (69)	

Table S3 (Continued)

Characteristics	HCV Antibody+		HCV Antibody-		P-value
		N=2 (%)		N=518 (%)	
Contact with Sewage					
	Yes	1 (50)		243 (47)	1.00*
	No	1 (50)		275 (53)	
Traditional HCV risk factors					
Blood transfusion or organ transplant before July 1992		0		10 (2)	1.00*
Receipt of clotting factor concentrate produced before 1987		0		1 (0.2)	1.00*
Receipt of long-term hemodialysis		0		0	ND
Receipt of blood from an HCV-infected donor		0		3 (1)	1.00*
Born to HCV-infected mother		0		3 (1)	1.00*
HIV or AIDS		0		0	ND
History of injecting drug use		0		0	ND
Needle stick, sharps, or mucosal exposure to HCV-infected blood as a health care, emergency medical or public safety worker		1 (50)		8 (2)	.03*

ND – Not defined.

*Analyzed using Fisher's Exact test.

Table S4. Characteristics of World Trade Center (WTC) truck drivers from a subset of the WTC General Responder Cohort, recruited and tested for HCV from December 15, 2016 – July 12, 2018 (N=24).

Characteristics	HCV Antibody+		HCV Antibody-		P-value
		N=3 (%)		N=21 (%)	
Demographics					
Sex					
	Male	2 (67)		20 (95)	.24*
	Female	1 (33)		1 (5)	
Time period of birth					
	1945 - 1949	0		1 (5)	.41*
	1950 - 1954	1 (33)		2 (10)	
	1955 - 1959	2 (67)		8 (38)	
	1960 - 1965	0		10 (48)	
Race					
	White	0		10 (48)	.24*
	Multi-Racial	2 (67)		5 (24)	
	Black	1 (33)		6 (29)	
Latino					
	Yes	2 (67)		5 (24)	.19*
	No	1 (33)		16 (76)	

Table S4 (Continued)

Characteristics	HCV Antibody+		HCV Antibody-		P-value
		N=3 (%)		N=21 (%)	
Insurance status (N=20)					
	Medicaid	0		1 (6)	.51*
	Medicare	1 (33)		2 (12)	
	Private insurance	2 (67)		14 (82)	
Born in the United States (N=23)					
	Yes	1 (50)		16 (76)	.46*
	No	1 (50)		5 (24)	
Main Exposures					
Contact with human remains					
	Yes	0		0	ND
	No	3 (100)		21 (100)	
Contact with blood and/or bodily fluids					
	Yes	1 (33)		0	.13*
	No	2 (67)		21 (100)	
Contact with Sewage					
	Yes	2 (67)		7 (33)	.53*
	No	1 (33)		14 (67)	
Traditional HCV risk factors					
	Blood transfusion or organ transplant before July 1992	0		1 (5)	1.00*
	Receipt of clotting factor concentrate produced before 1987	0		0	ND
	Receipt of long-term hemodialysis	0		0	ND
	Receipt of blood from an HCV-infected donor	0		0	ND
	Born to HCV-infected mother	0		0	ND
	HIV or AIDS	0		0	ND
	History of injecting drug use	0		0	ND
	Needle stick, sharps, or mucosal exposure to HCV-infected blood as a health care, emergency medical or public safety worker	0		0	ND

ND – Not defined.

*Analyzed using Fisher's Exact test.