

Supplementary Online Content

Patrick SW, Faherty LJ, Dick AW, Scott TA, Dudley J, Stein BD. Association among county-level economic factors, clinician supply, metropolitan or rural location, and neonatal abstinence syndrome. *JAMA*. doi:10.1001/jama.2018.20851

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This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods

Geographic Definitions

We designated counties as “urban” if they were classified as RUCC: 1 (county in metro area with >1 million population), 2 (county in metro area with 250,000 to 1 million population) or 3 (county in metro area with <250,000 population). We designated counties as “rural adjacent” if they were categorized as RUCC: 4 (county with population >20,000 adjacent to a metro area), 6 (county with a population of 2,500 to 19,999 adjacent to a metro area) or 8 (county with population of <2,500 adjacent to a metro area). We designated counties as “rural remote” if they were classified as RUCC: 5 (county with population >20,000 not adjacent to a metro area), 7 (county with a population of 2,500 to 19,999 not adjacent to a metro area), or 9 (county with population of <2,500 not adjacent to a metro area).

eTable 1. Pearsons Correlations Between 10-Year Moving Average of Unemployment and Poverty with Primary Care and Mental Health Shortage Areas

	Unemployment		Poverty	
	Mental Health	Primary Care	Mental Health	Primary Care
Overall	0.19	0.14	0.23	0.11
Metro	0.12	0.09	0.22	0.12
Rural Adjacent	0.10	0.12	0.21	0.14
Rural Remote	0.23	0.17	0.13	0.01

eTable 2. P-Values for Interaction Terms of Exposures of Interest and Metro, Rural-Adjacent and Rural Remote Counties

	Metro	Rural adjacent	Rural remote
	P-Value	P-Value	P-Value
Primary Care	ref	0.18	0.22
Mental health	ref	0.02	0.07
Obstetricians per 1000 population	ref	0.36	0.47
10-Year Moving Average Unemployment	ref	0.70	0.04
Percentage Manufacturing Jobs	ref	0.26	<0.001

eTable 3. Primary model with 10-Year Moving Average of Unemployment Rate & Current Poverty Rate

	aIRR	95%CI	P-Value
Employment Characteristics			
Unemployment			
10 year moving avg. (%)	1.10	0.99-1.22	0.07
Proportion of Manufacturing Jobs (%)	1.01	0.99-1.03	0.27
Provider Supply			
Shortage Areas			
Primary care	0.99	0.90-1.09	0.77
Mental health	1.16	1.08-1.26	<0.001
Obstetricians per 1000 Population	0.32	0.10-1.04	0.06
Socioeconomic Status			
Poverty (current year)	1.07	1.01-1.14	0.03
Year			
2009	Ref		
2010	1.20	1.13-1.30	<0.001
2011	1.48	1.37-1.61	<0.001
2012	1.70	1.54-1.86	<0.001
2013	2.04	1.85-2.26	<0.001
2014	2.39	2.15-2.66	<0.001
2015	2.97	2.66-3.30	<0.001

*model adjusted for county fixed effects and number of births.

eTable 4. Primary Model with 10-Year Moving Average of Poverty Rate

	aIRR	95%CI	P-Value
Employment Characteristics			
Proportion of Manufacturing Jobs (%)	1.01	0.99-1.03	0.28
Provider Supply			
Shortage Areas			
Primary care	0.98	0.89-1.08	0.70
Mental health	1.16	1.07-1.26	<0.001
Obstetricians per 1000 Population	0.30	0.09-0.98	0.045
Socioeconomic Status			
Poverty			
10 year moving avg. (%)	1.37	1.11-1.68	0.003
Year			
2009	Ref		
2010	1.23	1.16-1.31	<0.001
2011	1.51	1.41-1.61	<0.001
2012	1.70	1.57-1.84	<0.001
2013	2.05	1.84-2.02	<0.001
2014	2.31	2.10-2.56	<0.001
2015	2.82	2.53-3.14	<0.001

*model adjusted for county fixed effects and number of births.

eTable 5. Primary model with 10-Year Moving Average of Unemployment Rate, excluding New York State, 2009-2015

	aIRR	95%CI	P-Value
Employment Characteristics			
Unemployment			
10 year moving avg. (%)	1.11	0.99-1.23	0.07
Proportion of Manufacturing Jobs (%)	1.01	0.99-1.03	0.26
Provider Supply			
Shortage Areas			
Primary care	0.99	0.90-1.10	0.84
Mental health	1.17	1.07-1.28	<0.001
Obstetricians per 1000 Population	0.37	0.11-1.27	0.12
Year			
2009	Ref		
2010	1.23	1.15-1.33	<0.001
2011	1.50	1.38-1.64	<0.001
2012	1.74	1.58-1.92	<0.001
2013	2.07	1.86-2.30	<0.001
2014	2.44	2.17-2.73	<0.001
2015	2.99	2.66-3.35	<0.001

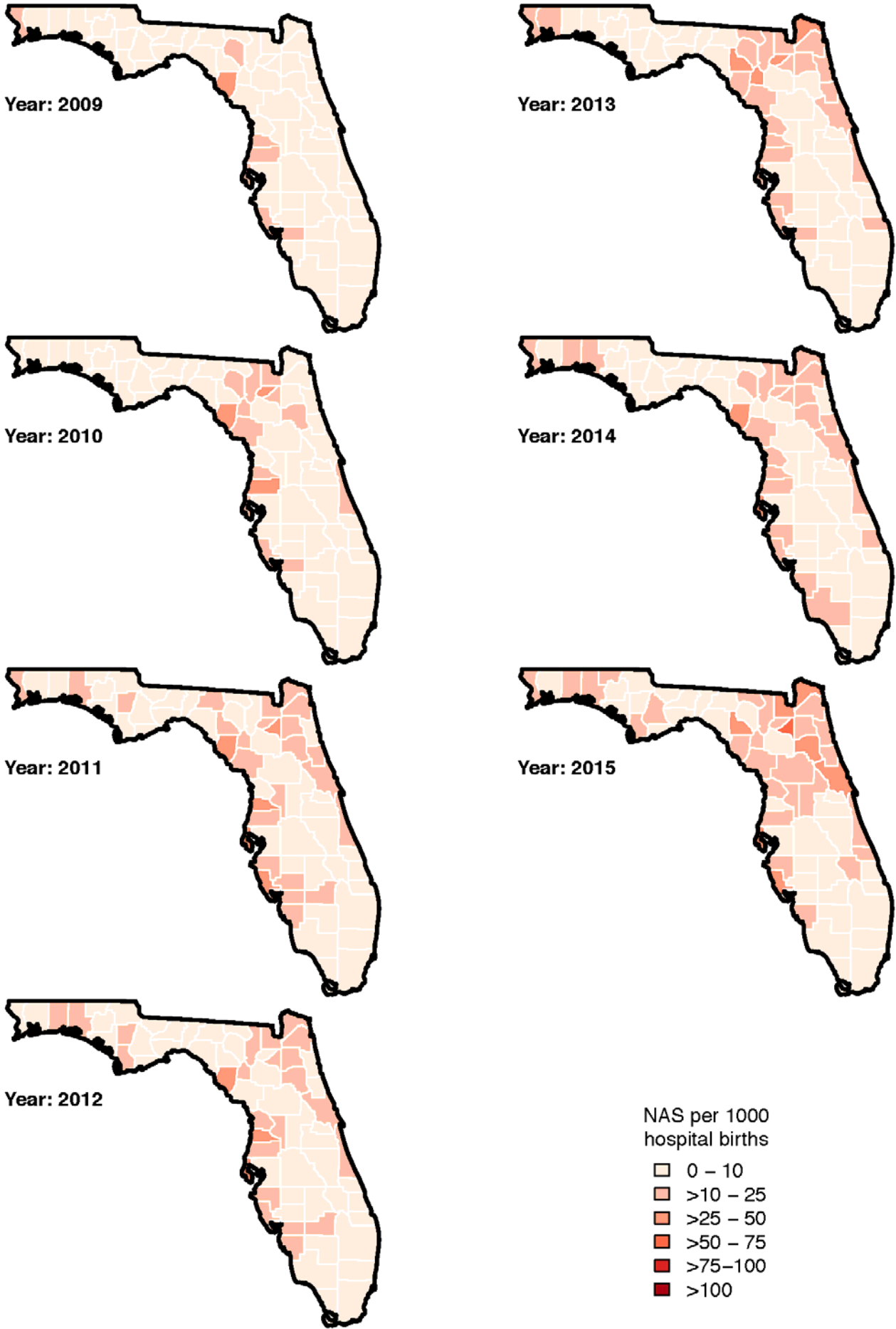
*model adjusted for county fixed effects and number of births.

eTable 6. Primary model with 10-Year Moving Average of Unemployment Rate, Full Sample of States, 2009-2014

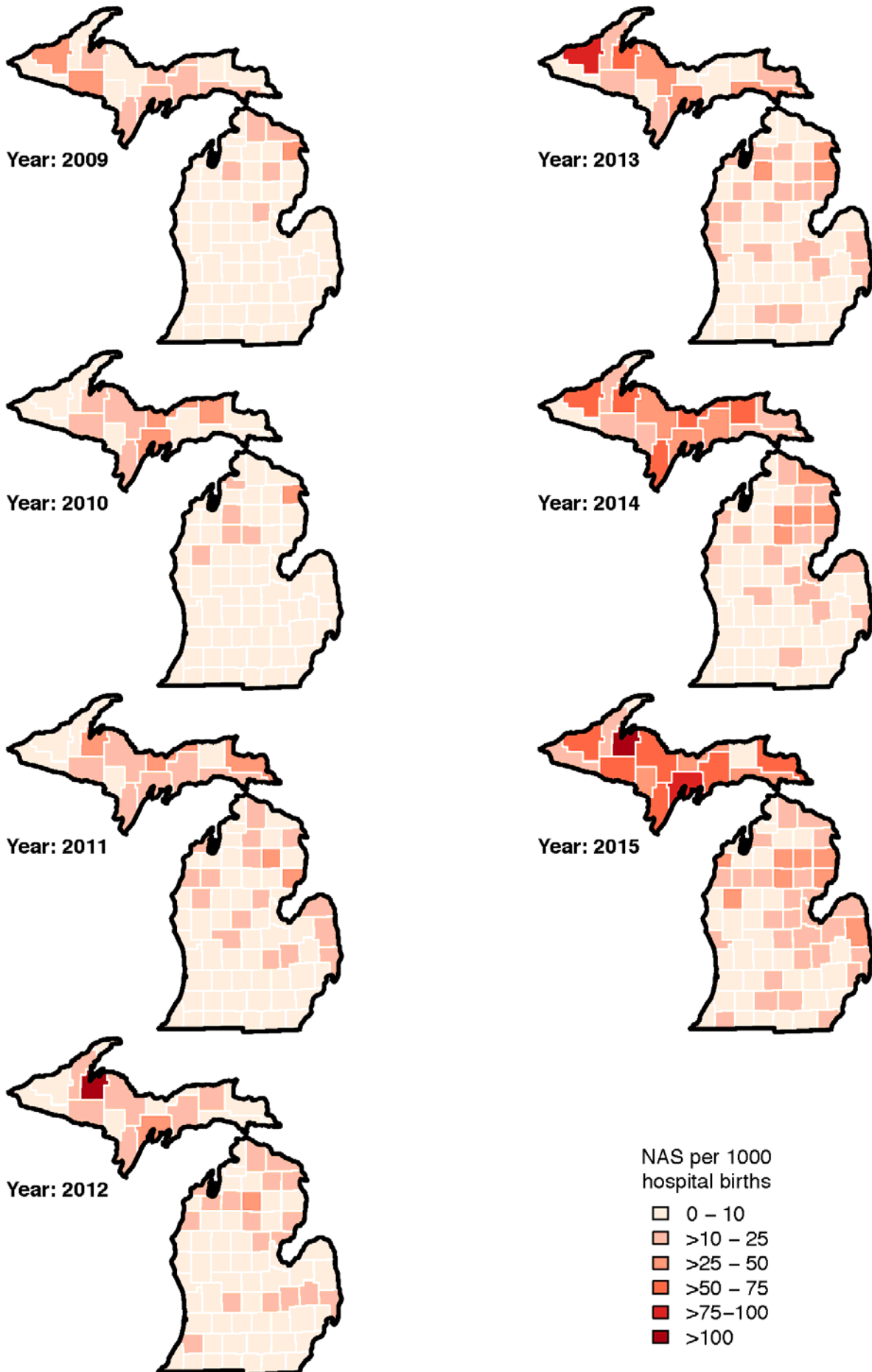
	aIRR	95%CI	P-Value
Employment Characteristics			
Unemployment			
10 year moving avg. (%)	1.15	1.02-1.29	0.02
Proportion of Manufacturing Jobs (%)	1.00	0.98-1.02	0.78
Provider Supply			
Shortage Areas			
Primary care	0.92	0.83-1.02	0.14
Mental health	1.18	1.08-1.30	<0.001
Obstetricians per 1000 Population	0.41	0.10-1.61	0.20
Year			
2009	Ref		
2010	1.20	1.13-1.29	<0.001
2011	1.47	1.35-1.61	<0.001
2012	1.67	1.51-1.85	<0.001
2013	2.01	1.80-2.24	<0.001
2014	2.34	2.01-2.63	<0.001

*model adjusted for county fixed effects and number of births.

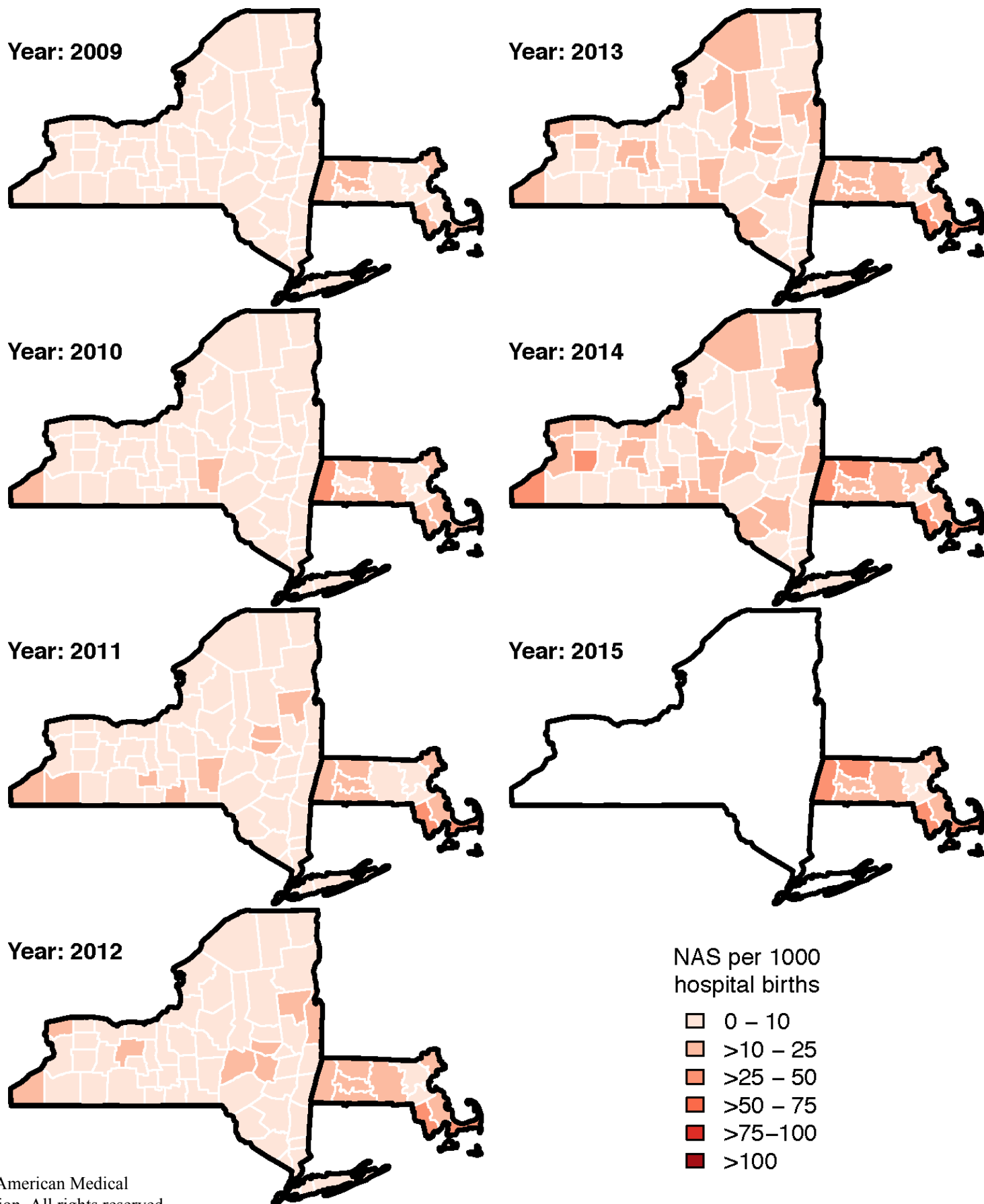
eFigure 1. Rates of Neonatal Abstinence Syndrome per 1000 Hospital Births, Florida 2009-2015



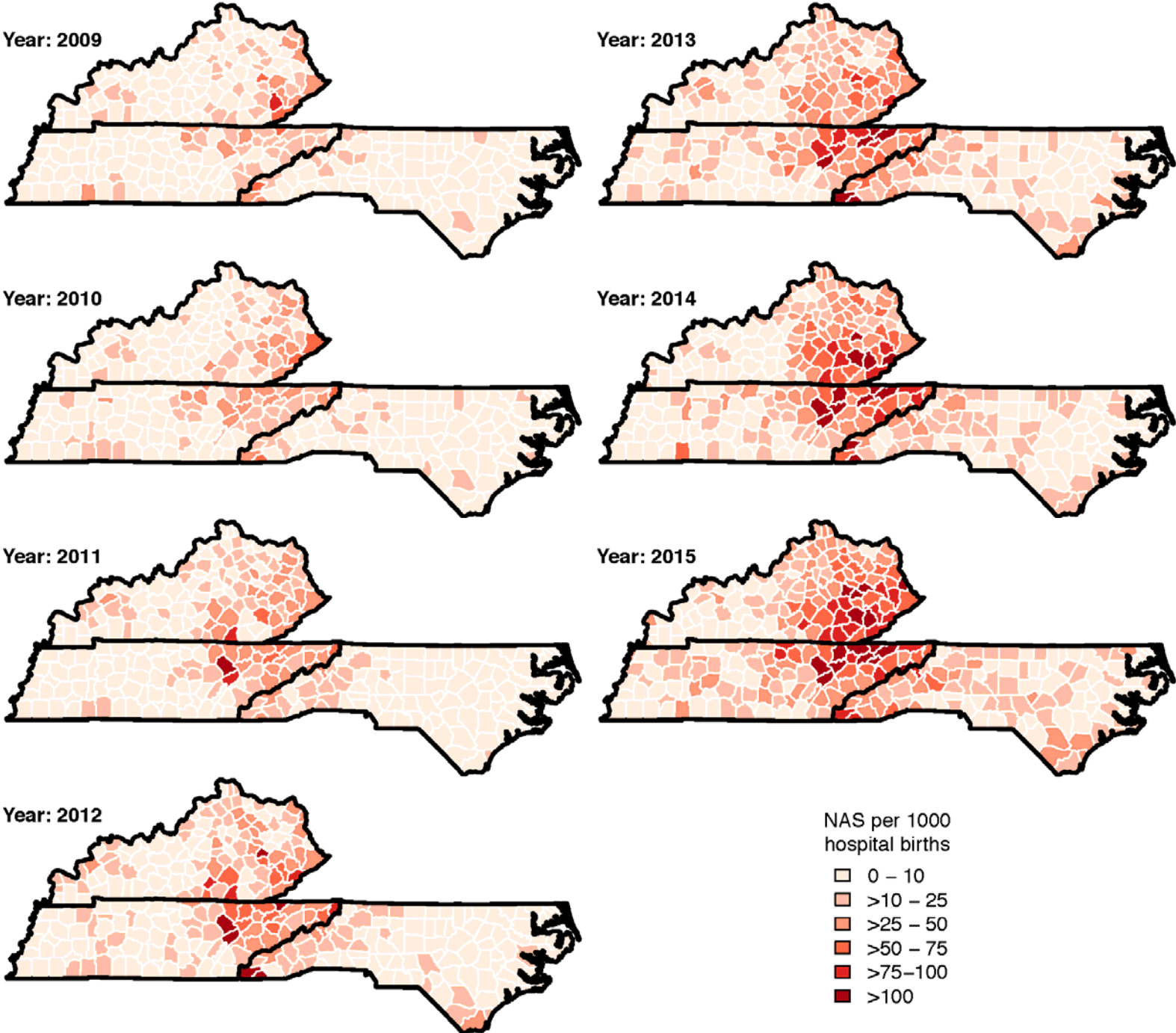
eFigure 2. Rates of Neonatal Abstinence Syndrome per 1000 Hospital Births, Michigan 2009-2015



eFigure 3. Rates of Neonatal Abstinence Syndrome per 1000 Hospital Births, Massachusetts and New York 2009-2015

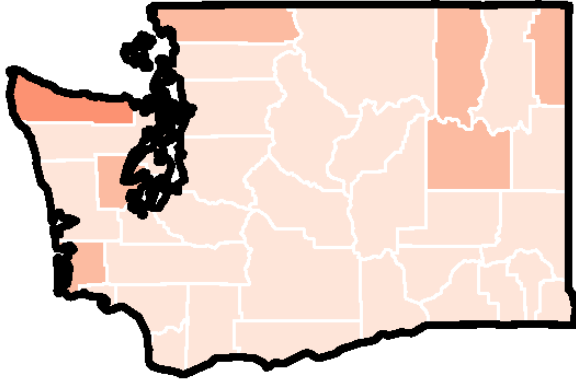


eFigure 4. Rates of Neonatal Abstinence Syndrome per 1000 Hospital Births, Kentucky, Tennessee, North Carolina 2009-2015

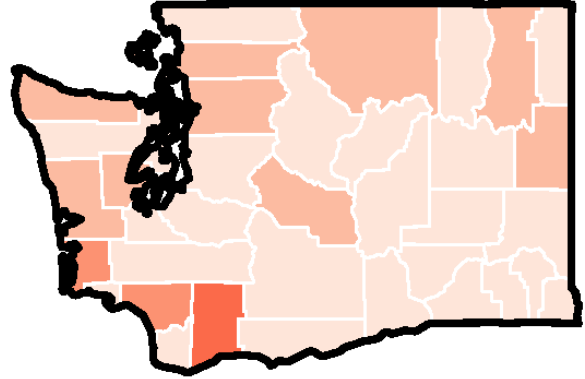


eFigure 5. Rates of Neonatal Abstinence Syndrome per 1000 Hospital Births, Washington 2009-2015

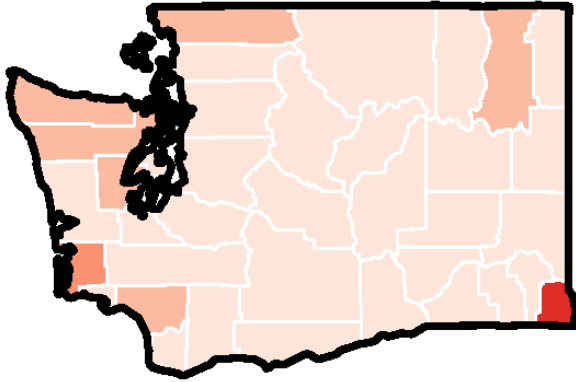
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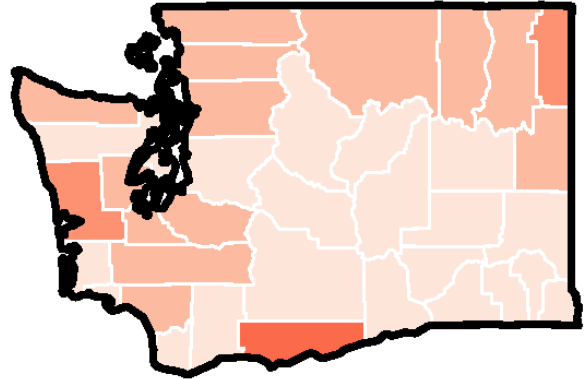
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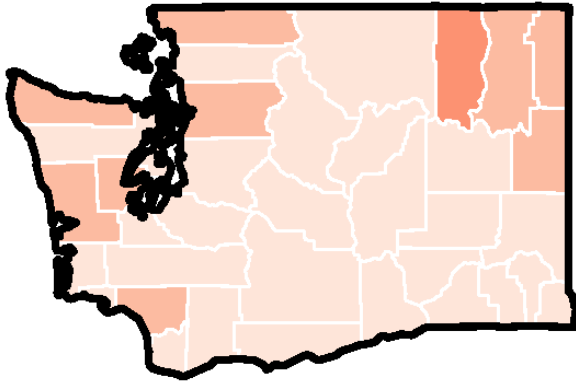
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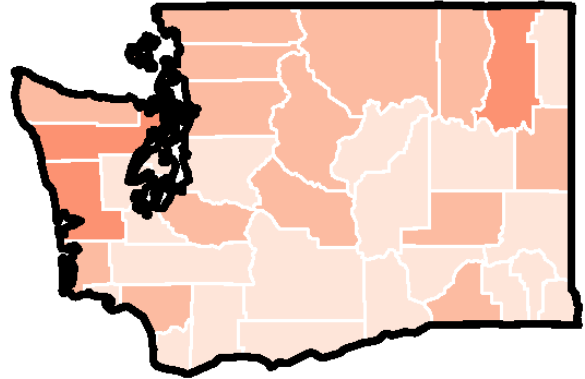
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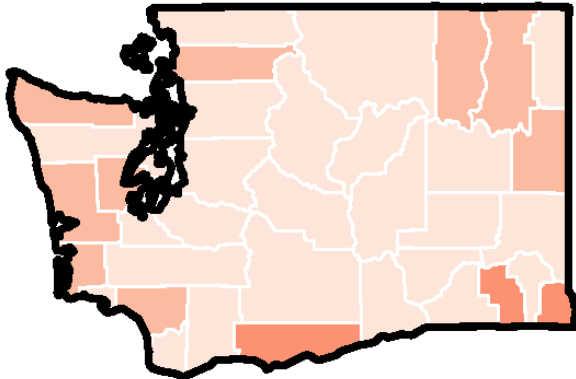
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Year: 2015



Year: 2012



NAS per 1000
hospital births

