Robert Wood Johnson Foundation

Childhood Obesity Prevention:

Social Network Analysis

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Founded in 1991, LeCroy & Milligan Associates, Inc. is a consulting firm specializing in social services and education program evaluation and training that is comprehensive, research-driven and useful. Our goal is to provide effective program evaluation and training that enables stakeholders to document outcomes, provide accountability, and engage in continuous program improvement.

With central offices located in Tucson, Arizona, LeCroy & Milligan Associates, Inc. has worked at the local, state and national level with a broad spectrum of social services, criminal justice, education and behavioral health programs.

The evaluation of childhood obesity has been dynamic and rewarding. We thank Laura Leviton for her guidance, expert advice, and support. The evaluation team of LeCroy & Milligan Associates included Elena Malofeeva, Ph.D., Kerry Milligan, MSSW, Deirdre Avery, M.S., MPH, as well as Robert Hanneman, Ph.D., Jacob Apkarian, M.A., and Miryam Ruvalcaba, B.A., from University of California, Riverside.

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As the nation's largest philanthropy devoted exclusively to improving the health and health care of all Americans, the Robert Wood Johnson Foundation works with a diverse group of organizations and individuals to identify solutions and achieve comprehensive, meaningful and timely change to reverse childhood obesity epidemic by 2015. This study examined social networks in the area of childhood obesity prevention for three separate dimensions of connectivity: advocacy/policy, training/technical assistance, and research. The focus of this social network analysis was not on mapping a full network with all connections between all members but rather on understanding relationships as represented by the 10 most influential organizations as named by each network member and the role RWJF played in such networks.

Organizations and individuals in the childhood obesity prevention network connect with one another directly for advocacy/policy- related issues, training/technical assistance, and research. They are also connected to one another by affiliation with RWJF's Childhood Obesity Prevention National Programs, by identification with shared issues (such as the six RWJF childhood obesity prevention priority areas), and with different types of constituency. This study reports on social networks in the area of childhood obesity prevention including describing connections in three dimensions of connectivity (i.e., advocacy/policy, training/technical assistance, and research), analyzing collaborations in RWJF's Childhood Obesity Prevention National Programs by six RWJF childhood obesity prevention priority areas, and with different types of constituency. Its focus is also on understanding where RWJF was positioned among key influential organizations in the area of childhood obesity prevention and the connections that RWJF and childhood obesity prevention network members would like to develop in future. The response rate for organizations (the unit of analysis) was 39%.

This research focused on the existing members of the Childhood Obesity Prevention network. First, experts in the field of Childhood Obesity Prevention were asked to identify organizations and individuals instrumental in reversing childhood obesity epidemic (the Key Informant Questionnaire). The RWJF Childhood obesity team, RWJF childhood obesity grantees, and some definite number of existing allies and partners related to the Childhood Obesity Prevention movement that were identified by Childhood Obesity

Prevention experts through the Key Informant Questionnaire were then contacted to participate in the Social Network Analysis (SNA) Survey.

To study the whole network, we initially asked each of the existing network members about their relationships with the rest of the members. This resulted in a very heavy respondent burden. We then proceeded to utilize a methodology frequently used in Social Network Analysis: to report on the relationships each respondent was having with the 10 most influential organizations or individuals that advanced RWJF's goal to reverse childhood obesity epidemic by 2015 in regards to three dimensions of connectivity:

- Advocacy and Policy-related issues;
- Training and Technical Assistance; and
- Research.

The organizations in the childhood obesity prevention network who responded to this survey, were quite diverse. They varied greatly in size and age. A majority of the organizations in the network were younger and smaller – particularly for community-based and research organizations. There was also a core of larger and older organizations (such as RWJF) that provided stability to the field. The participants in the childhood obesity prevention network were a mix of public, private, and non-profits, with non-profit organizations predominating.

The network could be subdivided into *the main component and periphery organizations*. The main component is the dense center of the network that has no connections to the periphery. A part of the main component is a network core.

The core consists of a tight central group of closely connected *hub* organizations. These are organizations that are connected by at least 2 or more strong ties. So every organization in the core is connected to at least 2 other core organizations by strong connections.

Hubs are central "peak" organizations that connect many others, and are connected to one another.

Peripheral organizations or *actors* are not connected to the rest of the network (to the core or the main component of the network).

Peripheral hubs are organizations that are highly connected in the periphery but not connected to the core of the network.

The organizations varied greatly in the priority areas they pursued within the campaign to end childhood obesity, as well as in their focus on local or national action. A brief summary of findings is provided below.

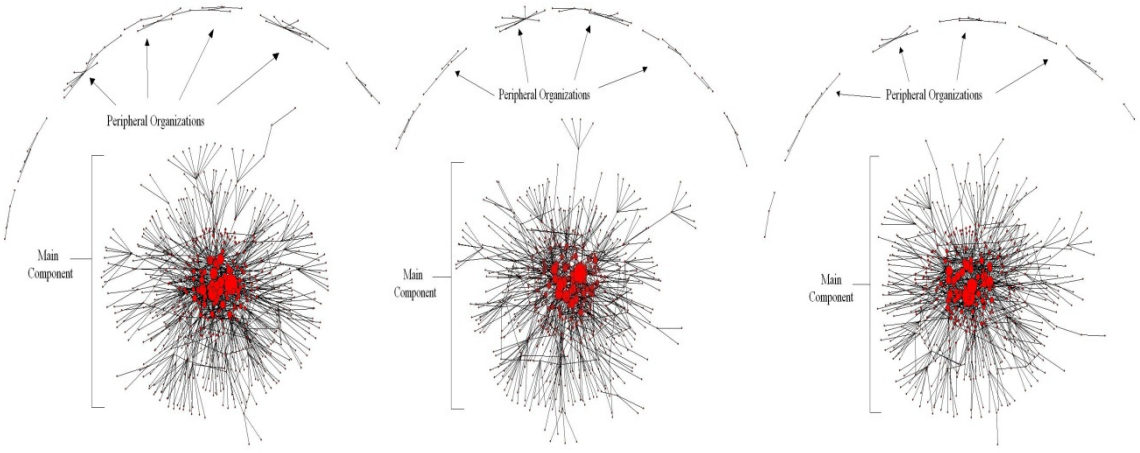
Members of the Three Childhood Obesity Prevention Networks

We asked respondents to report on their connections with the 10 most influential organizations or individuals with whom they connected in 2011 in advocacy/policy-related issues, training and technical assistance, and research in 2011. Each network had *a core set of organizations* that were connected to each other for advocacy/policy, training and technical assistance, or research. On the other hand, *peripheral organizations* existed that were not as strongly connected to the rest of the network.

> Network *ties* are the connections or relationships between nodes.
>
> *Nodes* are points on a network graph that represent actors. In this case, the nodes are organizations.

The global pattern of the three networks was somewhat similar (see Exhibit A, p. 4), yet different organizations constituted the main component and the peripheral organization depending on the dimensions of connectivity (see Exhibit C, p.8, Exhibit F, p.16, and Exhibit I, p.21).

Exhibit A. The Global Patterns of the Three Networks: Advocacy/Policy, Training and Technical Assistance, and Research



- RWJF played a central role in each of the three networks which could partially be due to the oversampling of RWJF staff and RWJF grant recipients. There were a number of other organizations that were *key influential actors* in each of the three childhood obesity prevention networks (Policy Link, Public Health Law and Policy, and YMCA of the USA, The Centers for Disease Control and Prevention, NIH, Yale University Rudd Center for Food Policy and Obesity, SDSU, UNC at Chapel Hill, and University of Arkansas) (see Exhibit E, p.13, Exhibit H, p.19, and Exhibit K, p.25).

  Key influential actors- organizations with an eigenvector centrality > 0.1.

- Some of the RWJF's Childhood Obesity Prevention National Programs were in the top 10 highly influential organization lists (in training/technical assistance Childhood Obesity Prevention network -- National Policy and Legal Analysis Network to Prevent Childhood Obesity and Leadership for Healthy Communities; in research --Active Living Research and Healthy Eating Research). In advocacy/policy-- none of the RWJF's Childhood Obesity Prevention National Programs were in the list of top 10 highly influential organizations.

Some of the key features of the connections (i.e., *ties*) among Childhood Obesity Prevention Network organizations can be summarized with statistical indexes (see Exhibit B, p.6). This summary compares the networks for advocacy/policy-related issues, training/technical assistance, and research.

Organizations responding to the survey reported a greater number of connections to other organizations for advocacy/policy than for training/technical assistance and research collaborations. The numbers of ties of survey respondents to other survey respondents were much more similar across connection types – but this was a result of the survey's methodology. In each of the three networks there was a large central component with a number of key players, as well as some peripheral organizations.

Within the core, the survey found that there were strong differences in the centrality or influence of organizations (eigenvector graph centralization). There was also a strong tendency for organizations to have ties to other organizations that were also tied to one another (clustering). These tendencies were similar across the three networks, and the positions of individual organizations within the network were similar across the networks.

The *clustering coefficient* is the measure of density within a local cluster. A value of one would indicate that every organization in a given local cluster is connected to every other organization in that cluster. A value of zero would indicate that none of the organizations in a given cluster is connected to other organizations.

Eigenvector graph centralization tells us how centrality values are distributed throughout the network. Values approaching zero indicate that all organizations are equally connected; values approaching one indicate that there is a single dominant organization.

Exhibit B. Network Connection Summary

	Advocacy/Policy	Training and Technical Assistance	Research
Overall# of connections, Mean	23.7	17.7	10.0
Overall # of connections, SD	65.5	57.6	24.0
Ties to survey respondents	8.7	7.8	8.4
Eigenvector Graph Centralization	56%	54%	53%
Clustering	.405	.409	.414
# of hubs in the periphery*	7	5	5

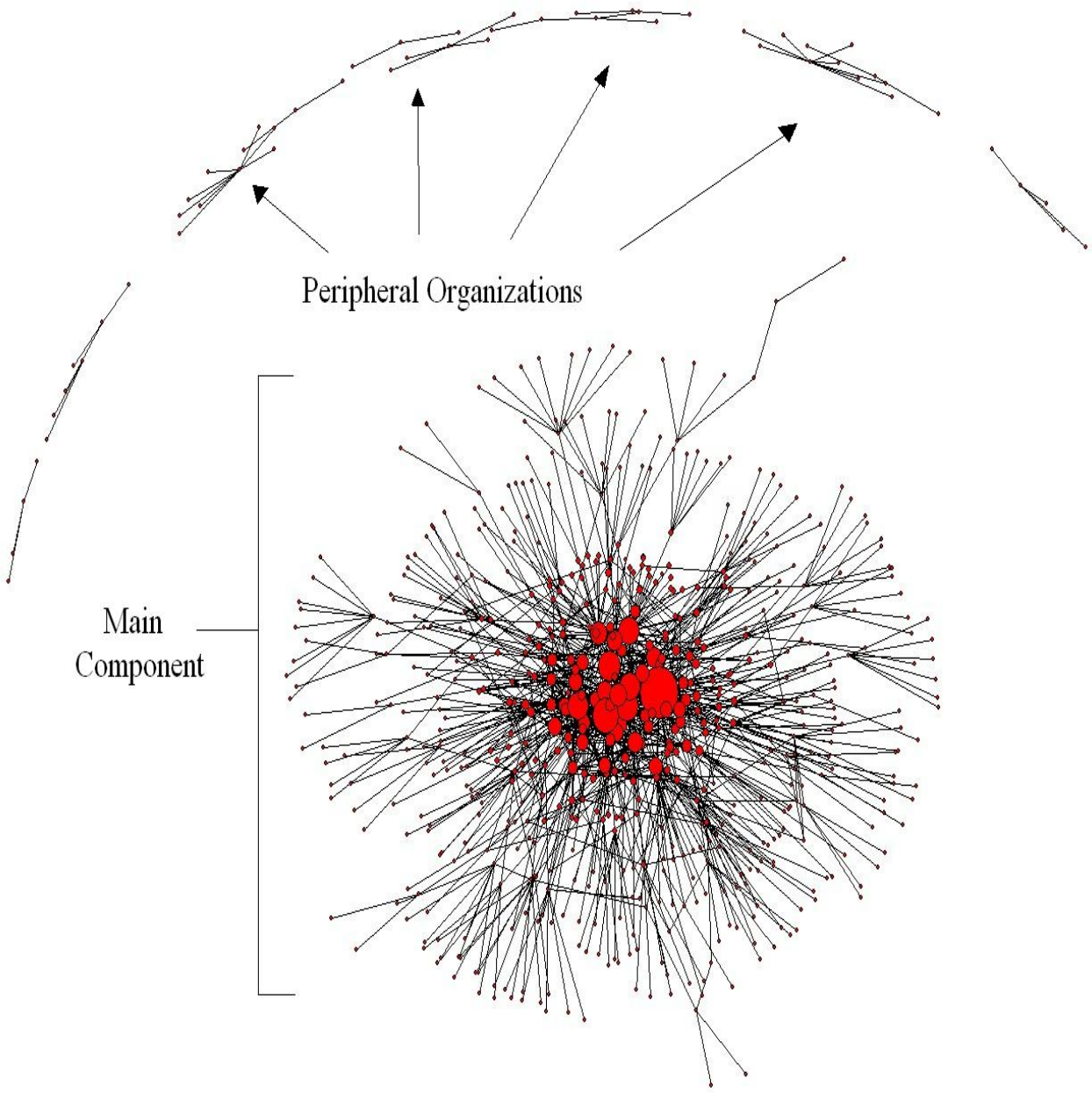
Note: * A peripheral hub is defined as any organization with at least three ties that is not connected to the main component.

Advocacy/Policy

Childhood Obesity Prevention Network organizations reported that on average in 2011, they were connected to 24 other organizations for childhood obesity advocacy/policy related matters (M = 23.7, SD = 65.5) (including both those who responded to the survey and others). There was tremendous variability in the extent of network connection for advocacy/policy. Some network members did not engage in advocacy/policy work, and had no such connections (5%). A small number of very active and central advocacy organizations reported that they connected with 500 or more organizations and individuals (1%).

The connections between organizations reporting collaborations in advocacy/policy work within the Childhood Obesity Prevention Network in 2011 are shown in the next exhibit. Organizations are shown as circles, and connections (i.e., network ties) between them are shown as lines connecting the circles. The sizes of the circles are proportional to the eigenvector centrality of the organization – that is, how influential or extensively connected the organizations (i.e., nodes) are. Organizations that are well connected to other organizations that are also well connected appear to have the largest size. The overall structure of the advocacy/policy network in childhood obesity prevention consists of a tight central core of closely connected hub organizations. In addition, we see a number of organizations near the fringes of the core that tie a considerable amount of other organizations to the core, which are not otherwise connected, to the core. Organizations that are not connected to the core of the network are called peripheral organizations. They also form peripheral hubs or organizations that that are highly connected in the periphery but not well connected to the network core.

Exhibit C. Childhood Obesity Prevention Advocacy/Policy Network



Note: Organizations are shown as red circles, and connections (i.e., ties) between them are shown as lines connecting the circles. The sizes of the circles are proportional to the eigenvector centrality of the organization – that is how influential or extensively connected organizations (i.e., nodes) are. Organizations that are well connected to other organizations that are also well connected appear to have the largest size. N=662 organizations.

We first describe the main component and the core of the advocacy/policy network. We then comment on what organizations constituted the periphery.

The graphic in Exhibit C, p.8 suggests, visually, that the network of advocacy/policy collaborations is very dense. But, this is not really the case. If we focus on only the large group of connected organizations in the middle, or main component, we find a relatively low density of connection (0.014). That is, there is a slightly larger than one percent chance that any one of these organizations is connected to any other one. The average number of advocacy/policy ties that these organizations report to other organizations that were included in the survey is 8.7 (they report an average of 24 ties to any other organizations for advocacy purposes). Despite the fairly low density of advocacy ties among the survey respondents, they do have substantial numbers of ties to one another for advocacy/policy purposes.

When we examined the surrounding region of each of the organizations in the core of the advocacy/policy network in detail (looked at its "one-step neighborhood" or "ego-network"), we identified organizations that were embedded in fairly dense *local clusters.* The *clustering coefficient* of the neighborhoods of organizations in the main component of the advocacy/policy network was 0.405. This degree of clustering was the lowest of the three networks. That is, slightly more than one third of the connections that could exist between each "ego's" neighbors were actually present.

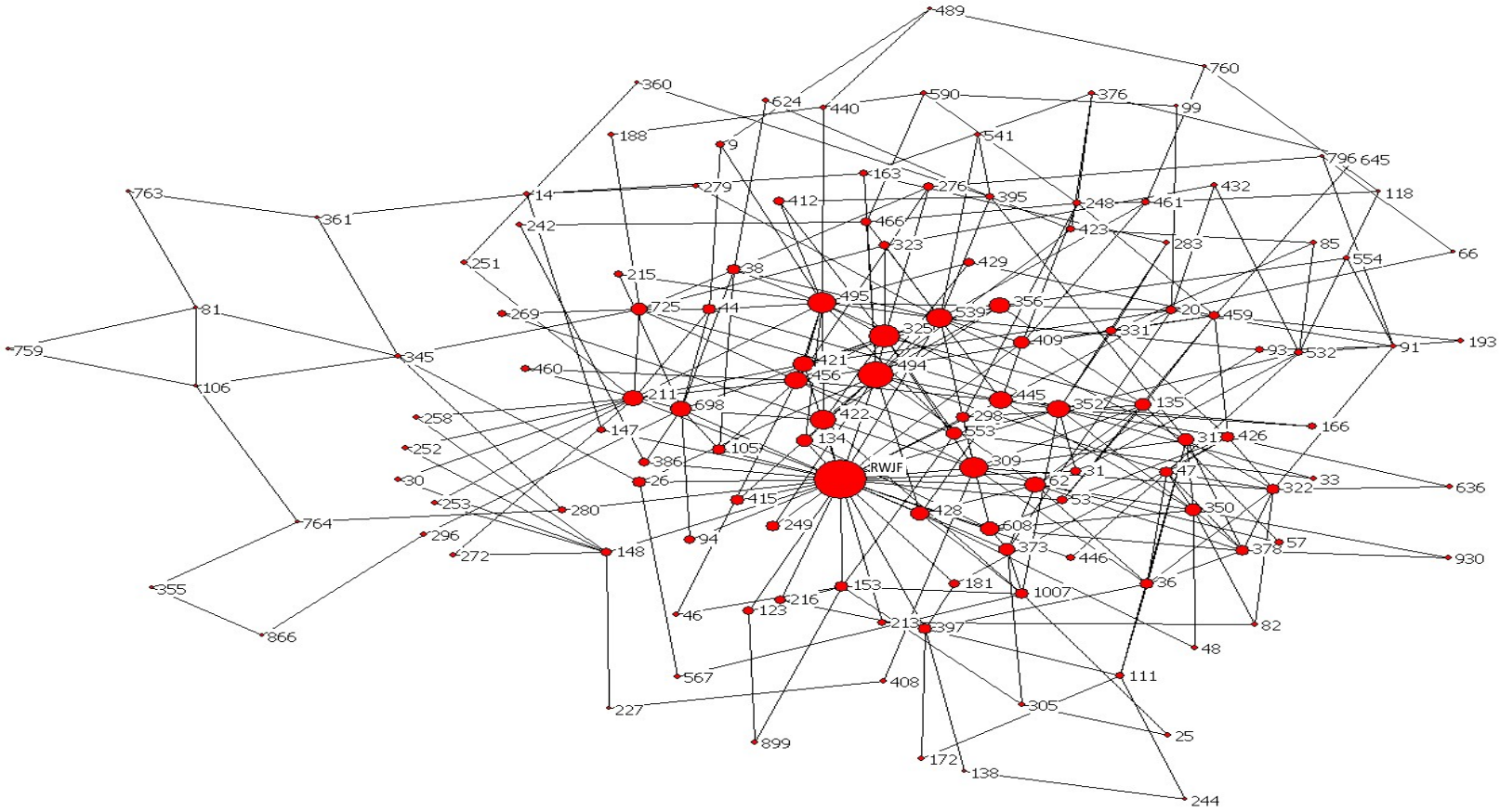
A *Local cluster* is a region of a network, within which, organizations on average are more closely connected to each other than to organizations outside of the cluster.

The *clustering coefficient* is the measure of density within a local cluster. A value of one would indicate that every organization in a given local cluster is connected to every other organization in that cluster. A value of zero would indicate that none of the organizations in a given cluster is connected to other organizations.

While advocacy/policy Childhood Obesity Prevention Network organizations did have locally dense patterns of repeated and strong collaborations with others, these local clusters were fairly open, and connected to organizations outside the community. Exhibit D, p.11 presents the detailed structure of the core of the advocacy/policy network of organizations with at least two strong ties.

This detailed snapshot of the center of the research network visually presents specific organizations that play important roles in connecting the network. The sizes of the circles help identify the key-influential actors since they are proportional to the eigenvector centrality of the organization – that is how influential or extensively connected organizations (i.e., nodes) are. Organizations that are well connected to other organizations that are also well connected appear to have the largest size.

Exhibit D. Childhood Obesity Prevention Advocacy/Policy Network – Network Core



Note: This exhibit only includes organizations from Exhibit C, p.8 with two or more strong ties to other organizations. Node sizes are proportional to eigenvector centrality.

We also note that there were considerable differences in the "influence" or "centrality" or extent to which organizations were "key-actors." This is indicated, visually, by the size of the circles in Exhibit D, p.11 It is often useful to assess the extent to which the network has one hub to which all other organizations connect, or many hubs (multiple organizations with many, but roughly equal numbers of connections). One numeric measure of this is the *eigenvector graph centralization*. For the advocacy/policy network, this graph centralization is 56%. This is slightly higher than for research (53%) or training/technical assistance (54%).

Eigenvector graph centralization tells us how centrality values are distributed throughout the network. Values approaching zero indicate that all organizations are equally connected; values approaching one indicate that there is a single dominant organization.

The somewhat more prominent role played by RWJF (organization with an id 340, see Exhibit E, p.13) in advocacy is apparent. RWJF could also be most central due to oversampling of the RWJF staff and grantees. There were a number of other important "key influential actors" at the center of the advocacy/policy network. Exhibit E, p.13 lists the most influential organizations in advocacy/policy as reported by survey participants. RWJF was closely positioned to most of the important influential actors.

Exhibit E. Ranking of Organizations in Advocacy/Policy Network by Eigenvector Centrality

Rank	ID	Centrality	Organization Name
1	340	0.419	RWJF Robert Wood Johnson Foundation
2	494	0.270	Yale University Rudd Center for Food Policy and Obesity
3	325	0.233	Public Health Law and Policy
4	309	0.213	Policy Link
5	495	0.200	YMCA of the USA
6	422	0.198	University of Arkansas for Medical Sciences
7	539	0.195	Centers for Disease Control
8	445	0.175	University of Minnesota School of Public Health
9	352	0.173	San Diego State University
10	456	0.163	University of North Carolina at Chapel Hill Gillings School of Global Public Health
11	62	0.155	Center for Science in the Public Interest CSPI
12	698	0.154	Health Kids, Healthy Communities*
13	211	0.141	Leadership for Healthy Communities*
14	356	0.141	Save the Children Federation Inc.
15	421	0.137	University of Arkansas
16	428	0.128	University of California, San Francisco (Center for Obesity Assessment, Study & Treatment)
17	608	0.127	California Endowment
18	134	0.115	Food Research and Action Center
19	135	0.113	The Food Trust
20	350	0.111	Samuels & Associates, Inc.
21	409	0.106	Tufts University John Hancock Research Center on Physical Activity, Nutrition, and Obesity Prevention
22	725	0.102	NPLAN
23	553	0.100	Safe Routes to School National Partnership

Note. * indicates RWJF's Childhood Obesity Prevention National Programs and initiatives. These rankings are based on data from 128 organizations that constitute the core or the main component of the network. Eigenvector graph centralization tells us how centrality values are distributed throughout the network. Values approaching zero indicate that all organizations are equally connected; values approaching one indicate that there is a single dominant organization.

Exhibit E, p.13 also presents how connected the RWJF Childhood Obesity Prevention initiatives and National Programs were to other organizations for advocacy/policy-related issues (they are marked with an asterisk). Healthy Kids, Healthy Communities ranked 12 and Leadership for Healthy Communities ranked 13 among the 128 core Childhood Obesity Prevention organizations that reported two or more strong ties to others. That is, some of the RWJF Childhood Obesity Prevention initiatives and National Programs are among the most central players in the networks of collaboration for advocacy/policy.

We next describe advocacy/policy network peripheral organizations. There were some "peripheral hub" organizations in advocacy/policy that had their own networks of other organizations that were not connected to the main component/core. Such hub organizations can be powerful in shaping advocacy/policy because they are locally influential, even though they are not part of the "inner circle." We note a few peripheral hubs which could be targets for strategic networking related to advocacy/policy:

- SWAH Empowerment Inc. (8 ties);
- the Tulane University School of Public Health and Tropical Medicine (8 ties);
- WHRO Center for Regional Citizenship (4 ties);
- Western Upper Peninsula Health Department (4 ties);
- the University of Maryland College of Health and Human Performance (3 ties);
- East Bay Asian Youth Center (3 ties); and
- The Princeton Education Foundation (3 ties).

Peripheral organizations or *actors* are not connected to the rest of the network (to the core or the main component of the network).

Peripheral hubs are organizations that are highly connected in the periphery but not connected to the core of the network.

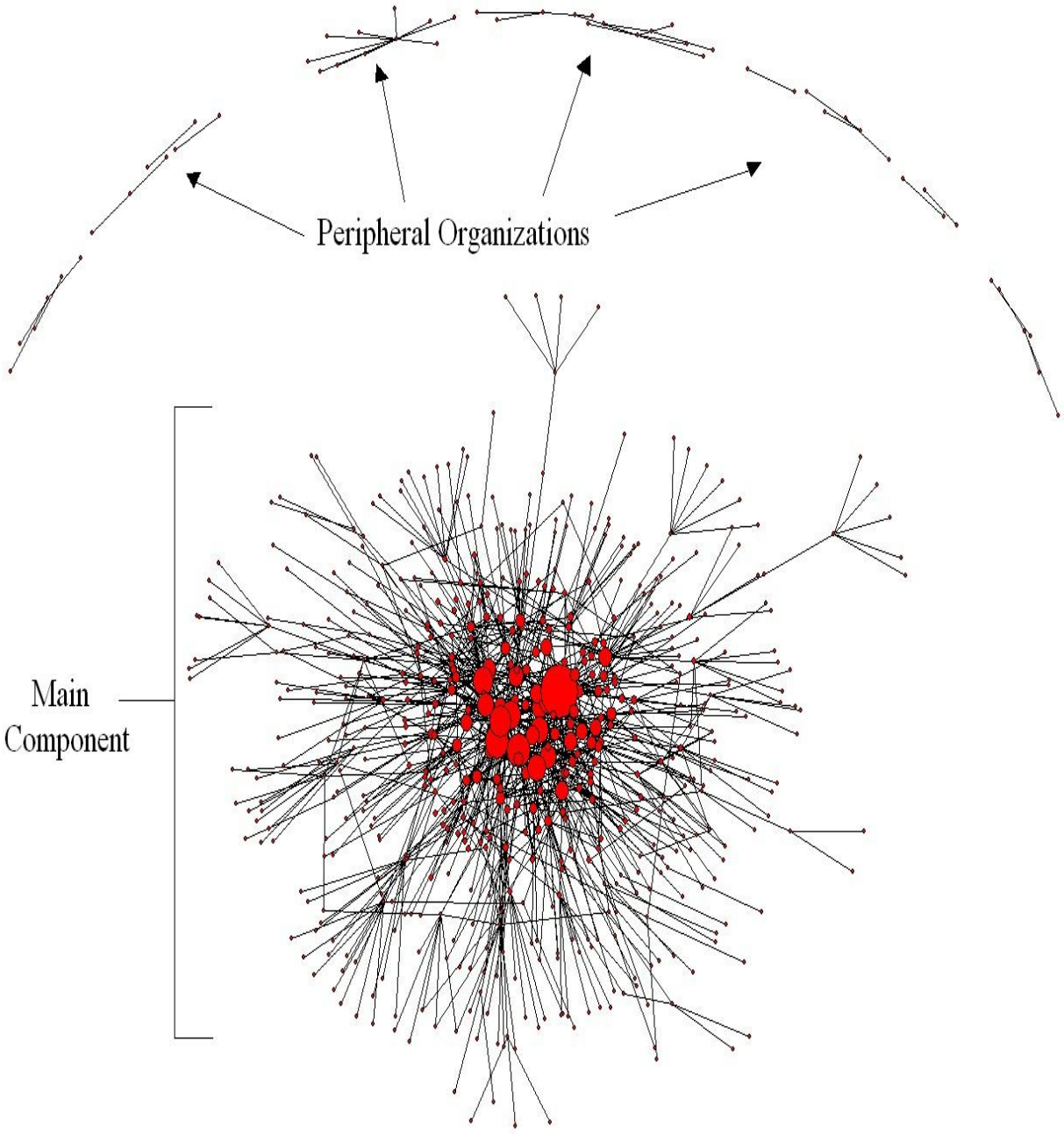
Each of these peripheral organizations had at least three ties along the advocacy/policy dimension but they were not connected to the main Childhood Obesity Prevention core network structure. Because we did not capture every existing tie in the network, these peripheral actors may have connected to the core; however, it was likely that even if they did, the connections were weak.

Training/Technical Assistance

The average number of connections among Childhood Obesity Prevention Network organizations in pursuing training/technical assistance activities was lower than for advocacy. The average number of contacts for technical assistance and training among all Childhood Obesity Prevention Network organizations (including both those who responded to the survey and others) was reported as 17.7. Variation across organizations in training/technical assistance connections was also extremely large (*SD* = 57.6) with many organizations having no connections (12%) and a very small number of organizations reporting being connected with 500 or more other organizations (1%).

We first describe the main component and the core of the training/technical assistance Childhood Obesity Prevention Network. We then comment on what organizations were in the periphery. Exhibit F, p.16 presents the overall network composition. The overall structure of the training/technical assistance network was quite similar to that of the advocacy/policy network. It included the organizations that formed the core and the main component of the network and those that were peripheral in nature. The organizations that constituted the core and the periphery were somewhat different than for the other two networks.

Exhibit F. Childhood Obesity Prevention Training/Technical Assistance Network



Note: Organizations are shown as red circles, and connections (i.e., ties) between them are shown as lines connecting the circles. The sizes of the circles are proportional to the eigenvector centrality of the organization – that is how influential or extensively connected organizations (i.e., nodes) are. Organizations that are well connected to other organizations that are also well connected appear to have the largest size. N=606 organizations.

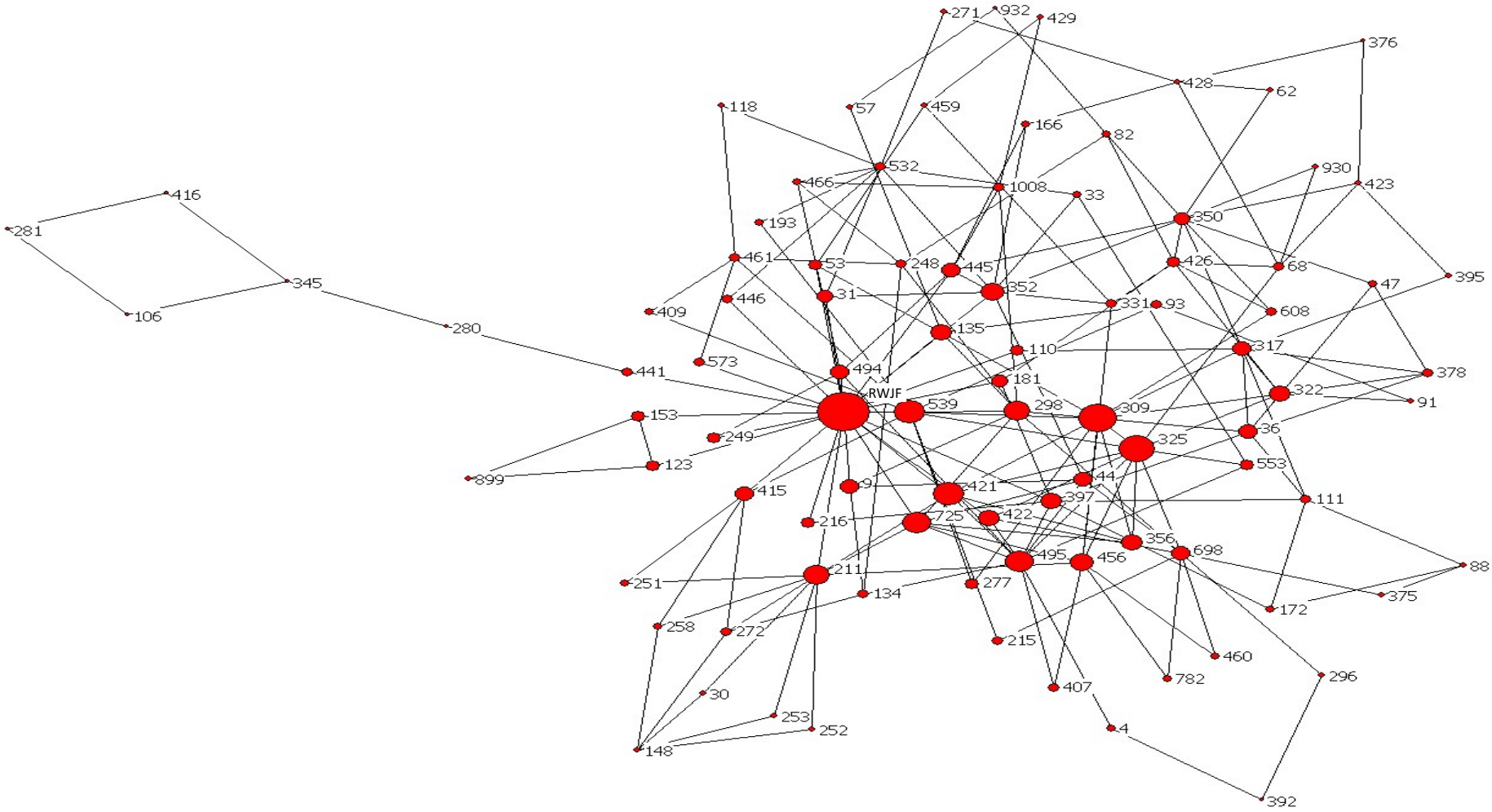
The density of a network is the ratio of present connections to all possible connections. Visually, the network of training/technical assistance collaborations was very dense. The density of the main component of the training/technical support network was 0.014, similar in value to the advocacy/policy network. That is, there was a slightly larger than one percent chance that any one of these organizations was connected to any other one. On average, the organizations had 7.8 connections to other survey respondents (compared to 8.7 for advocacy/policy). The respondents also reported a somewhat smaller number of connections to all organizations in the Childhood Obesity Prevention Network for training/technical assistance than for advocacy/policy (i.e., 58 versus 66).

On average, the local clusters of organizations in the training/technical assistance network were the same density than those in advocacy (the clustering coefficients are 0.409 and 0.405, respectively). Organizations within local clusters were more closely connected to each other on the average than to organizations outside of the clusters. The average clustering coefficient (0.409) indicated that slightly more than one third of the connections that could exist between each "ego's" neighbors were actually present. This clustering coefficient indicated that organizations that had training/technical assistance ties operated in local communities or clusters that were fairly tightly connected, and less tightly connected to other organizations.

There were some "peripheral hub" organizations in training/technical assistance that had their own networks of other organizations that were not connected to the main core. Such peripheral hub organizations can be powerful in shaping training/technical assistance because they were locally influential, even though they were not part of the "inner circle." The extent to which the main component was dominated by a single "star organization" rather than many "hubs" in the training/technical assistance network (54%) was slightly less than it was for advocacy (56%).

Exhibit G, p.18 describes organizations in the core of the training/technical assistance network that had at least two strong ties to other connections. This detailed map of the center of the research network visually presents specific organizations that play important roles in connecting the network.

Exhibit G. Childhood Obesity Prevention Training/Technical Assistance Network – Network Core



Note: This exhibit only includes organizations from Exhibit F, p.16 with two or more strong ties to other organizations. Node sizes are proportional to eigenvector centrality.

RWJF (organization with an id 340) was identified as the most influential organization. The top key influential organizations in the training/technical assistance network are presented in Exhibit H, p.19.

Exhibit H. Ranking of Organizations in Training/Technical Assistance Network by Eigenvector Centrality

Rank	ID	Centrality	Organization Name
1	340	0.401	RWJF Robert Wood Johnson Foundation
2	309	0.272	Policy Link
3	325	0.260	Public Health Law and Policy
4	539	0.227	Centers for Disease Control
5	421	0.213	University of Arkansas
6	495	0.210	YMCA of the USA
7	725	0.202	National Policy and Legal Analysis Network to Prevent Childhood Obesity *
8	211	0.178	Leadership for Healthy Communities*
9	298	0.175	Partnership for a Healthier America
10	456	0.163	University of North Carolina at Chapel Hill Gillings School of Global Public Health
11	352	0.156	San Diego State University
12	135	0.148	The Food Trust
13	397	0.148	Praxis Project Inc.
14	422	0.146	University of Arkansas for Medical Sciences
15	322	0.140	Public Health Institute
16	356	0.139	Save the Children Federation Inc.
17	445	0.129	University of Minnesota School of Public Health
18	317	0.128	Prevention Institute
19	698	0.128	Health Kids, Healthy Communities
20	36	0.126	Berkeley Media Study Group
21	494	0.126	Yale University Rudd Center for Food Policy and Obesity
22	44	0.118	Burness Communications
23	415	0.113	United States Conference of Mayors
24	9	0.111	Alliance for a Healthier Generation AFHG
25	350	0.104	Samuels & Associates, Inc.

Note. * indicates RWJF's Childhood Obesity Prevention initiatives and National Programs. These rankings are based on data from 93 organizations that constitute the core or the main component of the network. Eigenvector graph centralization tells us how centrality values are distributed throughout the network. Values approaching zero indicate that all organizations are equally connected; values approaching one indicate that there is a single dominant organization.

There are some "peripheral hub" organizations in training/technical assistance that had their own networks of other organizations that were not connected to the main component/core. Such hub organizations can be powerful in shaping training/technical assistance because they were locally influential, even though they were not part of the "inner circle." Each of these peripheral organizations had at least three ties in training/technical assistance to other organizations in the Childhood Obesity Prevention Network but was not connected to the core. Therefore, among those in the periphery (organizations that were not connected to the core of the network), these organizations were the peripheral hubs. In the technical assistance and training Childhood Obesity Prevention Network, the peripheral hubs included:

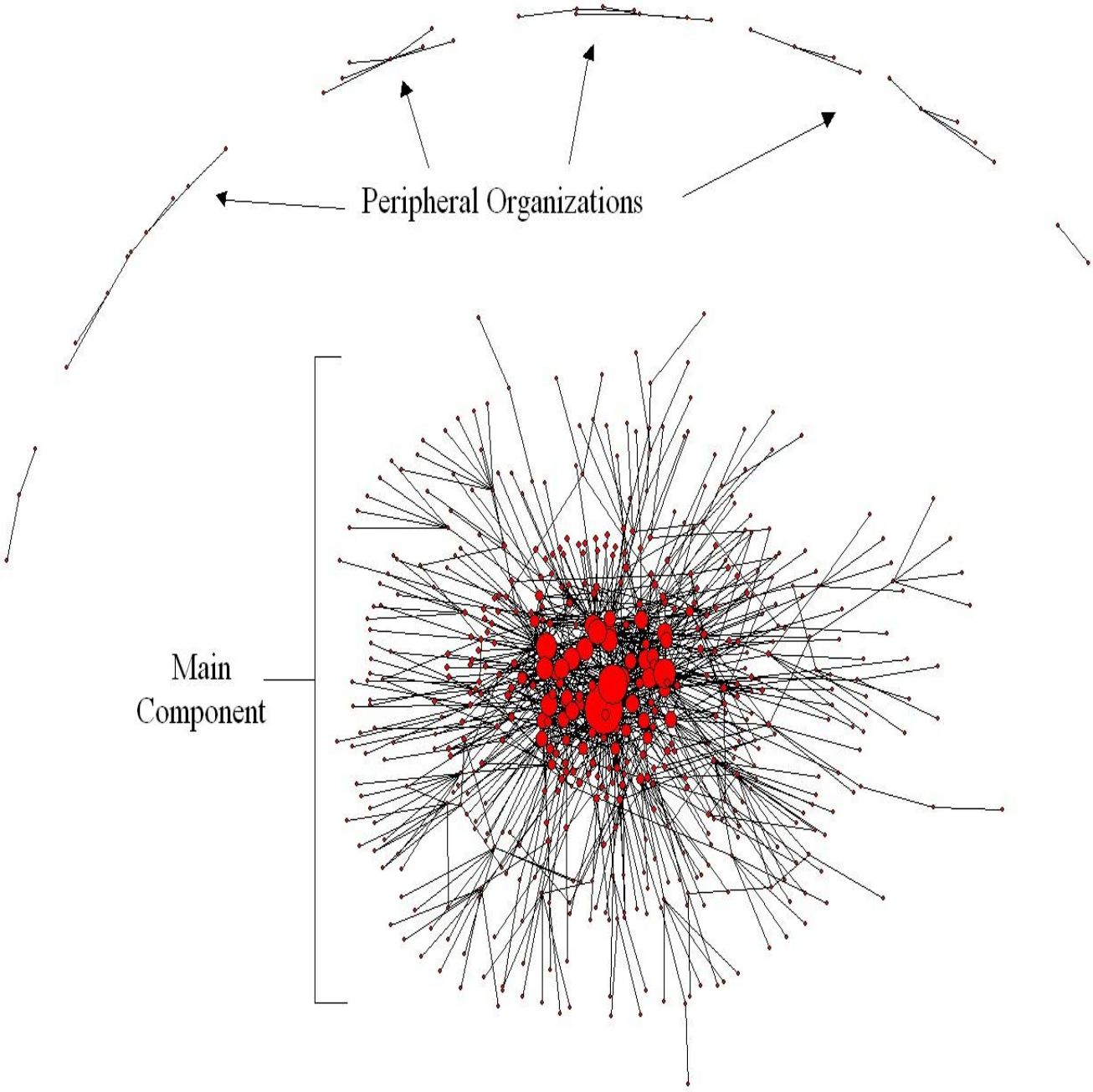
- SWAH Empowerment Inc. (10 ties);
- the Tulane University School of Public Health and Tropical Medicine (5 ties);
- Western Upper Peninsula Health Department (3 ties);
- the Princeton Education Foundation (3 ties); and
- Greenberg Quinlan Rosner Research Inc. (3 ties).

Research

Childhood Obesity Prevention Network organizations had less dense connections in pursuing research. On average, organizations reported an average of 10 connections with other organizations in the Childhood Obesity Prevention Network for research purposes. Again, the variability in the density of connections for research was large (*SD* = 24). Some organizations did not conduct research activities, and reported no such connections (8%). The single largest reported number of contacts for research was 175.

We first describe the main component or the core of the research Childhood Obesity Prevention Network. We then comment on what organizations were in the periphery. Exhibit I, p.21 presents the overall network composition. The overall structure of the research network was quite similar to that of the other two networks. It too includes the organizations that formed the core or the main component of the network and those that were peripheral in nature. The organizations that constituted the core and the periphery were somewhat different than for the other two networks.

Exhibit I. Childhood Obesity Prevention Research Network



Note: Organizations are shown as red circles, and connections (i.e., ties) between them are shown as lines connecting the circles. The sizes of the circles are proportional to the eigenvector centrality of the organization – that is how influential or extensively connected organizations (i.e., nodes) are. Organizations that are well connected to other organizations that are also well connected appear to have the largest size. N=566 organizations.

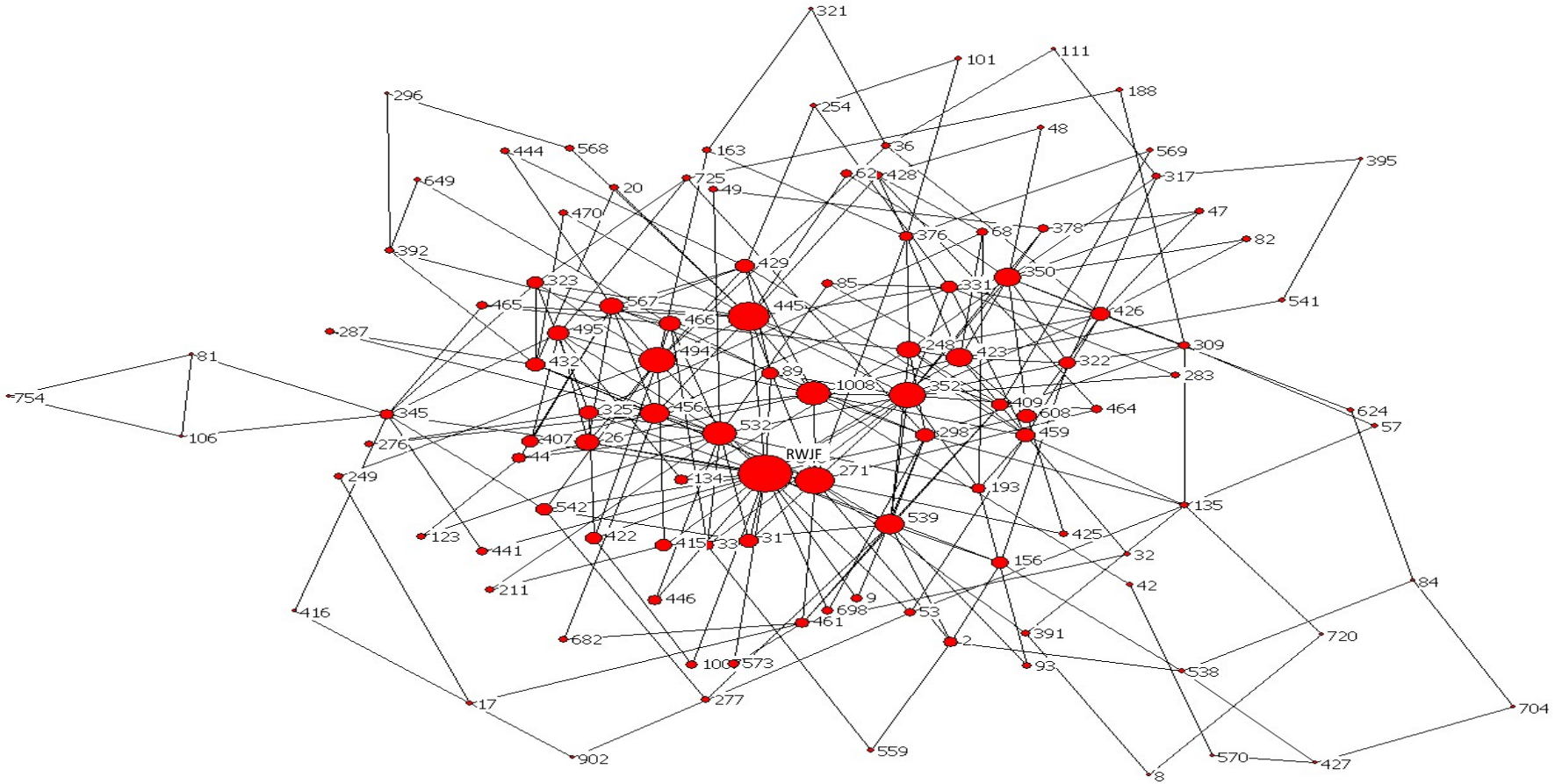
Like the other two networks, the research network had a large inter-connected inner core. These were research organizations that either were directly tied, or were tied at very short path distances. Many of the organizations that were not a part of the inner-most core were directly connected to one or two members of it. It is also worth noting that there were some hub research organizations that have their own networks of other organizations that were connected to the research core only though the hubs. Such hub organizations can be powerful in shaping research because they are locally influential, even though they are not part of the "inner circle."

The density of a network is the ratio of present connections to all possible connections. Visually, the network of research collaboration was very dense. When we focused on only the large group of connected organizations in the middle, or main component, we found a density of connections equal to 0.016. That is, there was a slightly larger than one and a half percent chance that any one of these organizations is connected to any other one. This tells us that the research network is about 14% denser than the other two networks. That is, there was a slightly larger than one and a half percent chance that any one of these organizations is connected to any other one. The average number of research ties that these organizations had to other survey respondents was 8.4, which fell in between the other two networks (8.7 for advocacy, 7.8 for training). The organizations reported fewer ties to all Childhood Obesity Prevention Network organizations for research than for advocacy/policy or training/technical assistance.

We examined the surrounding region of each of the organizations in the core of the research network in detail (looked at its "one-step neighborhood" or "ego-network"). Research organizations were embedded in local clusters. Organizations within local clusters were more closely connected to each other on the average than to organizations outside of the clusters. The average clustering coefficient (0.414) indicated that slightly more than one third of the connections that could exist between each "ego's" neighbors were actually present. This clustering coefficient indicated that organizations that had research ties operated in local communities or clusters that were fairly tightly connected, and less tightly connected to other organizations.

For the research network, its graph centralization was 53%. This moderate value implied that there was a gradation with one or two giant actors and an increasingly larger number of smaller actors as size decreased. This can be visually confirmed by examining the core component in Exhibit J, p.24. In this exhibit, we included only those organizations that had at least two strong ties to others. This detailed snapshot of the center of the research network visually presents organizations that played important roles in connecting the network.

Exhibit J. Childhood Obesity Prevention Research Network – Network Core



Note: Only includes organizations from Exhibit I, p.21 with two or more strong ties to other organizations. Node sizes are proportional to eigenvector centrality. Node locations are based on a spring-embedded rendering of the first two dimensions of a non-metric multi-dimensional scaling of geodesic distances.

Not surprisingly, RWJF (organization with an id 340) appeared as the most influential organization in the research network. It is important to note, however, that there were a substantial number of other organizations that were very well connected – and often connected to other prominent research organizations that did not report direct ties to RWJF. A list of the prominent organizations at the core of the research network is given in Exhibit K, p.25.

Exhibit K. Ranking of Organizations in Research Network by Eigenvector Centrality

Rank	ID	Centrality	Organization Name
1	340	0.363	RWJF Robert Wood Johnson Foundation
2	445	0.271	University of Minnesota School of Public Health
3	271	0.247	NIH
4	494	0.240	Yale University Rudd Center for Food Policy and Obesity
5	352	0.228	San Diego State University
6	532	0.226	Active Living Research*
7	1008	0.225	Healthy Eating Research*
8	539	0.188	Centers for Disease Control
9	456	0.180	University of North Carolina at Chapel Hill, Gillings School of Global Public Health
10	350	0.166	Samuels & Associates, Inc.
11	423	0.157	University of California, Berkeley, College of Environmental Design
12	567	0.152	Bridging the Gap
13	248	0.144	National Academy of Sciences-Institute of Medicine
14	26	0.142	Arizona State University School of Nutrition and Health Promotion
15	466	0.120	University of Texas at Dallas
16	495	0.120	YMCA of the USA
17	429	0.117	University of Illinois at Chicago
18	298	0.115	Partnership for a Healthier America
19	426	0.115	University of California, Los Angeles
20	31	0.109	Auburn University
21	432	0.108	University of Florida
22	459	0.104	University of Pennsylvania
23	325	0.103	Public Health Law and Policy
24	608	0.101	California Endowment

Note. * indicates RWJF's Childhood Obesity Prevention initiatives and National Programs. These rankings are based on data from 110 organizations that constitute the core or the main component of the network. Eigenvector graph centralization tells us how centrality values are distributed throughout the network. Values approaching zero indicate that all organizations are equally connected; values approaching one indicate that there is a single dominant organization.

The organizations around the outer edge of the exhibit (peripheral organizations) were organizations that have research ties with others, but did not have ties to any of the organizations in the large central cluster (main component). These organizations could represent strategic targets for organizations in the center of the network. In the research network, the peripheral hubs included:

- the Stapleton Foundation for Sustainable Urban Communities (6 research ties);
- the Tulane University School of Public Health and Tropical Medicine (4 ties);
- WHRO Center for Regional Citizenship (4 ties);
- University of Southern Maine at Gorham (3 ties); and
- Partners for Active Living (3 ties).

Each of these peripheral organizations had at least three ties along the research dimension to other organizations in the Childhood Obesity Prevention field but was not connected to the main network. On the whole, despite the density of connections in the core, there are many opportunities available for fostering new ties in the research network. More dense connection could increase the speed of diffusion of ideas, and the breadth of knowledge of the embedded organizations.

Comparison of the Three Childhood Obesity Prevention Networks

The global pattern of the three Childhood Obesity Prevention Networks was somewhat similar, yet different organizations constituted the core and the peripheral organization depending on the dimension of connectivity. Overall, the correlation between the training/technical assistance network and the advocacy/policy network was very strong (r=0.80, $p < 0.01$). That is, a large proportion of all the organizations that connected to one another for advocacy/policy issues also connected for training/technical assistance (the correlation is a number that ranges from zero to one, with zero indicating no correspondence between the two networks, and one indicating that the networks were identical). The advocacy/policy network also overlapped with the research network to a considerable degree (r =0 .71, $p < 0.01$).

The training/technical assistance network overlapped with the research network in a similar fashion ($r = 0.70$, $p < 0.01$).

It is useful to compare some basic statistics that describe the connections within the main component of the advocacy/policy network to those for research and training/technical assistance. The overall density in the core of the advocacy/policy network was 0.0144. This was similar to the value for training/technical assistance, and lower than density in the research network.

Organizations that collaborated with others in advocacy/policy reported on average 8.7 such strong ties – compared to 7.8 for training/technical assistance and 8.4 for research. That is, the density of connections and the number of collaborators was higher in advocacy/policy and research than in training/technical assistance. This was somewhat at variance with the reported numbers of ties to all other organizations in the Childhood Obesity Prevention Network (i.e., both survey respondents and others). The number of research contacts in this broader network is, on the average, lower than for training. Since the survey targeted RWJF grant recipients (many of which were primarily research organizations), the difference between the numbers of ties among survey respondents (advocacy/policy highest, research second, and training and technical assistance third) and reports of all contacts (advocacy/policy highest, training/technical assistance next highest, research lowest), is probably due to sampling.

It was determined that among organizations that were identified by survey respondents, the most common type of connection was along the advocacy dimension. Advocacy ties were more than twice as common as research ties (average of 23.7 ties for advocacy compared to 10.3 for research). Ties related to technical assistance and training were more common than research ties but less common than advocacy ties at 17.7 per organization. However, according to the SNA the density of the three different types of networks did not vary all that much. The degree to which advocacy/policy organizations were embedded in dense local communities was similar to the other two dimensions, and none were particularly high. This may be due in part to the fact that respondents were limited in the number of ties that they were allowed to report.

Four important implications follow:

- When the strong connections in the core of the networks were examined, the key actors in the networks were identified. The most central actor in all three networks was RWJF which could partially be due to the oversampling of RWJF staff and RWJF grant recipients. Some of the RWJF's Childhood Obesity Prevention National Programs were also highly connected. In the training/technical assistance network, National Policy and Legal Analysis Network to Prevent Childhood Obesity and Leadership for Healthy Communities were among the 10 most central actors at positions 7th and 8th respectively. In research, two other National Programs, Active Living Research and Healthy Living Research ranked 6th and 7th respectively. In advocacy/policy network, none of the RWJF's Childhood Obesity Prevention National Programs were in the list of top 10 most central actors. Healthy Kids, Healthy Communities and Leadership for Healthy Communities were just outside the top 10 (they ranked 12th and 13th respectively).
- Key universities included Yale University, whose Rudd Center for Food Policy and Obesity was a highly central actor in both the advocacy and research networks (top four in both), along with SDSU and UNC at Chapel Hill who ranked top eleven in all three networks. University of Arkansas was highly central in advocacy as well as technical assistance and training (top six in both), and University of Minnesota was a key actor in advocacy (the 8th) and research (the 2nd). Many of these universities housed RWJF's Childhood Obesity Prevention National Programs which allowed them to act as mediators between RWJF initiatives and the rest of the Childhood Obesity Prevention Network.
- This research also revealed other key actors in the Childhood Obesity Prevention field. Policy Link, Public Health Law and Policy, and YMCA of the USA were highly central actors in both the advocacy/policy and the training/technical assistance networks (all top six or higher in centrality ranking). The Centers for Disease Control and Prevention was a key actor in all three networks (top eight or higher). The National Institute of Health was also one of the most central actors (3rd) in the research network.

These organizations listed were not only highly connected to RWJF, but they are also highly connected to other organizations in the Childhood Obesity Prevention Network. They were important hubs that might be used for distributing resources and information from RWJF to the rest of the network.

- From the full network diagrams of each dimension of connectivity (see Exhibit C, p.8, Exhibit F, p.16, and Exhibit I, p.21) peripheral organizations existed that were not as strongly connected to the rest of the network. These might be organizations with which RWJF would want to strengthen relationships. In the advocacy as well as the training and technical assistance networks, SWAH Empowerment Inc. had the most connections among peripheral actors. Stapleton Foundation for Sustainable Urban Communities was the most well connected peripheral actor in the research network. The Tulane University School of Public Health and Tropical Medicine was a well connected peripheral actor in all three networks.

RWJF's Childhood Obesity Prevention National Programs

RWJF is committed to reversing the obesity epidemic by 2015. To date, the foundation has committed $500 million to this cause, with funding distributed across seven initiatives and authorizations and 11 RWJF's Childhood Obesity Prevention National Programs.

- The majority of organizations responding to this survey were affiliated with at least one RWJF's Childhood Obesity Prevention National Programs, with a third affiliated with more than one National Program.
- Of those organizations that acted as bridges connecting multiple National Programs, most were RWJF's Childhood Obesity Prevention National Programs themselves.
- Active Living Research was the most central (i.e. is the most connected) of the National Programs, and Information for Action: School Policies to Prevent Childhood Obesity was the least central (see Exhibit L, p.30).

Exhibit L. Two-Mode Eigenvector Centralities of RWJF's Childhood Obesity Prevention National Programs Linking Organizations

National Program	Centrality Score
Active Living Research	.510
Healthy Eating Research	.430
RWJF Center	.402
Healthy Kids, Healthy Communities	.357
National Policy and Legal Analysis	.311
Salud America	.202
Leadership for Healthy Communities	.187
Active Living Resource Center	.181
Communities Creating Healthy Environments	.152
New Jersey Partnership for Healthy Kids	.150
Information for Action: School Policies to Prevent Childhood Obesity	.120

There was clustering of RWJF's Childhood Obesity Prevention National Programs in the Childhood Obesity Prevention network, where certain Programs appeared more tightly connected to each other than to the rest of the Programs. The National Policy and Legal Analysis Network to Prevent Childhood Obesity and Healthy Eating Research were closely connected. Healthy Kids, Healthy Communities and the Center formed another cluster. New Jersey Partnership for Healthy Kids: Communities Making a Difference to Prevent CO, Active Living Resource Center, and Leadership for Healthy Communities: Advancing Policies to Support Healthy Eating and Active Living also formed a cluster.

RWJF's Priority Areas

RWJF funds efforts at the local, state, and federal level to change public policies and community environments in ways that promote improved nutrition and increased physical activity in six policy priority areas. Key findings with regard to the policy areas were as follows:

- Childhood Obesity Prevention network organizations were typically involved in multiple priority areas.
- Childhood Obesity Prevention network organizations working in the same priority areas were more likely to be connected to each other than to organizations working in other priority areas.
- Geographic region influenced involvement in specific priority areas.
- An organization that works in more than one priority area is also a member of more than one community of organizations, and potentially acts as a "bridge" between the communities that center on each of the priorities. Such "bridging" organizations may be particularly important as "key influential actors" because of their ability to reach and influence organizations that work in individual priority areas. Childhood Obesity Prevention network organizations that work in multiple priority areas, therefore, have a wide diversity of contacts, and may be able to influence organizations that specialize in few priority areas. Such organizations are also important because they can identify and build synergies among the communities of organizations that are more narrowly specialized. A list of 28 organizations that were involved in all six priority areas is provided in Appendix H, p. 140 of the main report.
- RWJF priority areas are more than just shared interests among network participants. They are "contexts" or "settings" by which organizations identify their place in the Childhood

RWJF's Priority Areas

1. Ensuring that all foods and beverages served and sold in schools meet or exceed the most recent Dietary Guidelines for Americans.
2. Increasing access to affordable foods through new or improved grocery stores and healthier corner stores and bodegas.
3. Increasing the time, intensity, and duration of physical activity during the school day and out-of-school programs.
4. Increasing physical activity by improving the built environment in communities.
5. Using pricing strategies—both incentives and disincentives—to promote the purchase of healthier foods.
6. Reducing youth exposure to unhealthy food marketing through regulation, policy, and effective industry self-regulation.

Obesity Prevention network. And, as organizations choose to affiliate with various-RWJF priority areas, they also define the relationships among those areas. Therefore, if a very large number of organizations choose to emphasize both priorities "A" and "B", but only a few emphasize both "A" and "C", we will come to see "A" and "B" as similar or related more than "A" and "C" are. Certain of the RWJF priority areas, then, are more "central" to the Childhood Obesity Prevention network than others. That is, certain priority areas have many more organizations that share joint interests in them.

One numerical measure of this "centrality" of the program areas can be calculated with a measure called the 2-mode eigenvector centrality. It is similar to the eigenvector centrality described in Exhibit E, p.13, Exhibit H, p.19 and Exhibit K, p.25. However, this measure applies to priority areas rather than organizations in this section.

Exhibit M. RWJF Childhood Obesity Prevention Priority Area Centralities

Priority Area	2-Mode Eigenvector Centrality
Increasing physical activity by improving the built environment in communities (Priority 4)	.496
Increasing the time, intensity, and duration of physical activity during the school day and out-of-school programs (Priority 3)	.475
Increasing access to affordable foods through new or improved grocery stores and healthier corner stores and bodegas (Priority 2)	.447
Ensuring that all foods and beverages served and sold in schools meet or exceed the most recent Dietary Guidelines for Americans (Priority 1)	.377
Reducing youth exposure to unhealthy food marketing through regulation, policy, and effective industry self-regulation (Priority 6)	.356
Using pricing strategies—both incentives and disincentives—to promote the purchase of healthier foods (Priority 5)	.245

The priority area "Increasing physical activity by improving the built environment in communities" (Priority 4) was the most connected of the six priority areas (see Exhibit M, p.32 for a list of priority areas by degree of connectedness). Organizations involved in that priority area were more likely to be involved in collaborating with other organizations. "Using pricing strategies—both incentives and disincentives—to promote the purchase of healthier foods" (Priority 5) was the least connected priority area.

Impacting the Field beyond the Childhood Obesity Prevention Network

The organizations that make up the Childhood Obesity Prevention network interface with many different types of constitueny in pursuing their goals. We analyzed how organizations that worked in childhood obesity prevention related to the 13 specific types of constituency. These types were similar to those types used in the SNA on Healthy Eating Research conducted from 2007 to 2010.[1] Understanding this general profile of the types of constituency among Childhood Obesity Prevention network members, RWJF can target its communications and influence efforts to address the most central concerns of Childhood Obesity Prevention network members.

The type of the organization, region in which organizations were located, size, age, and funding also influenced the types of constituency with which they were associated.

- Public organizations tended to have weaker relationships with the media, medical groups, and philanthropies and stronger relationships with professional and research organizations. Private organizations tended to have weaker ties with professional organizations and stronger ties with philanthropies. Non-profits tended to have stronger ties with the media and philanthropies.
- Childhood Obesity Prevention network members from the Midwest and South regions tended to have stronger ties with advocacy groups, while East and Mountain West members had weaker ties. Network members in the Midwest and West regions tended to have stronger ties with federal government agencies, while the South appeared to have weaker ties. Organizations located in the East tended to have stronger

[1] http://www.rwjf.org/childhoodobesity/product.jsp?id=24331.

ties to private organizations, while the other regions seemed to have weaker ties. Network members located in the South and West tended to have stronger ties with state government organizations, while those in the East appeared to have weaker ties.

- Larger respondent organizations had stronger ties with Federal government, media, and research organizations. Larger respondent organizations had weaker ties with community-based organizations.
- Newer respondent organizations tended to have stronger relationships with advocacy groups and philanthropies.
- Childhood Obesity Prevention network members that had never received RWJF's funding tended to have weaker ties to the media and stronger ties to philanthropies. Childhood Obesity Prevention network organizations had the strongest connections with community, research, and advocacy groups and the weakest connections with for profit, media, medical, professional, and government organizations. Many government organizations are very important in childhood obesity prevention (e.g., CDC, state health departments), and do work extensively with the organizations surveyed here. However, the organizations surveyed here reported stronger ties with non-governmental organizations.
- Childhood Obesity Prevention network organizations working with the same types of constituency were more likely to be connected to each other than to organizations working with different types of constituency.

13 different types of constituency:

1) advocacy groups
2) community-based organizations
3) federal government agencies
4) local government agencies
5) media
6) medical practitioners
7) philanthropies
8) policy-makers
9) private industries/for-profit organizations
10) professional organizations
11) research organizations
12) school systems
13) state government agencies.

- Organizations that have strong ties to many different kinds of other organizations may be particularly important "key-influential actors" in the network. Organizations that have strong ties to many kinds of organizations outside the Childhood Obesity Prevention network may be particularly important as change agents that can make connections between the Childhood Obesity Prevention network and the broader organizational environment. By analyzing the network of connections between organizations and the types of organizations with which they have strong ties, we can identify those organizations that are particularly "central." A list of organizations that had strong ties to many other kinds of organizations outside the Childhood Obesity Prevention network is included in Appendix I, p. 141 of the main report.
- By looking at how types of constituency were indirectly connected to each other through relationships with particular organizations, we can identify the most central types of constituency in the Childhood Obesity Prevention network. One way of indexing the strength of connection of Childhood Obesity Prevention network members and types of constituency is to identify the constituencies that are most graph-central in making connections among Childhood Obesity Prevention members. Community organizations were the most connected to Childhood Obesity Prevention organizations that were also connected to other types of constituency. Advocacy groups, policy makers, and research organizations were also more likely to be connected to Childhood Obesity Prevention organizations that were also connected to other types of constituency. It was least likely for this to be the case for private/for profit organizations, medical practitioners, professional organizations, and media.

Building Future Childhood Obesity Prevention Networks of Collaboration

One goal of this research was to look at how future links might be built: to identify strategic targets for "networking."

- A list of organizations RWJF should be connected to is presented in Exhibit 25, pp. 89-91 (abbreviated) of the main report.

- A list of organizations survey respondents would like to be connected to is presented in Exhibit 26, pp. 92-93 (abbreviated) of the main report.

Recommendations

The following section highlights key findings and recommends strategies based on these findings.

❖ *Develop intentional strategies on how to better utilize hub organizations in advocacy/policy, training/technical assistance, and research.*

In this study, RWJF was found to be one of the most influential organizations in the Childhood Obesity Prevention network in the United States. Also identified were other key actors in the Childhood Obesity Prevention field. Policy Link, Public Health Law and Policy, and YMCA of the USA were highly central actors in both the advocacy/policy and the training/technical assistance networks (all were ranked sixth or higher in centrality rankings). The Centers for Disease Control and Prevention was a key actor in all three networks (ranked eighth or higher). The National Institute of Health was also one of the most central actors (ranked third) in the research network. Finally, Childhood Obesity Prevention organizations that work in multiple priority areas might be viewed as key influential actors as they have a wide diversity of contacts, and may be able to influence organizations that specialize in one or fewer priority areas.

Peripheral hubs existed that were not as strongly connected to the rest of the network. These might be organizations with which RWJF would want to strengthen relationships.

❖ *Identify strategies to address how RWJF's Childhood Obesity Prevention National Programs could play a more central role in communications around advocacy and policy-related issues, training/technical assistance, and research with specific emphasis paid to advocacy/policy network.*

In the advocacy/policy network, none of the RWJF's Childhood Obesity Prevention National Programs were in the list of the top 10 most central actors. Examining how Healthy Kids, Healthy Communities and Leadership for Healthy Communities could be more active in connecting among advocacy/policy network organizations might be beneficial to the Childhood Obesity Prevention field.

- *Continue monitoring RWJF's Childhood Obesity Prevention National Program communications and standing in the field. Identify gaps and areas of emphasis.*

Active Living Research was found to be the most central (i.e. is the most connected) of the RWJF's Childhood Obesity Prevention National Programs, and Information for Action: School Policies to Prevent Childhood Obesity, New Jersey Partnership for Healthy Kids, and Communities Creating Healthy Environments were the least central (see Exhibit 16, p. 68 of the main report).

Monitoring least central National Programs such as Communities Creating Healthy Environments will further RWJF's influence. More "central" National Programs and priority areas (i.e., Increasing physical activity by improving the built environment in communities" (Priority 4)) might be favored as targets for influence by RWJF, as these Programs bring together larger numbers of the most actively affiliated organizations.

- *Learn from successful initiatives to improve the effectiveness of the childhood obesity prevention campaign.*

Several of the organizations and RWJF Childhood Obesity Prevention National Programs appear to be quite successful in leveraging organizational ties to build affiliations with influential organizations in the field of Childhood Obesity Prevention (e.g., Active Living Research).
Two of the priority areas, for example, stood out from the others in the extent to which organizations working in the priority area were likely to have a direct collaboration: Increasing the time, intensity, and duration of physical activity during the school day and out-of-school programs (Priority 3) and Increasing physical activity by improving the built environment in communities (Priority 4).

- *Prioritize what types of constituency childhood obesity prevention organizations should be connected to.*

Prioritization could be based on the following sources of data:

- The connections among organizations and constituencies that existed in 2011. Are these the connections that RWJF wants? Where might it want more, as in the case of polity/advocacy?
- The list of organizations survey respondents recommended with which RWJF should be connected.
- The list of organizations to which survey respondents said that they themselves wanted to be connected.

A goal for building an effective campaign against childhood obesity is to be able to access and influence constituencies outside the organizations in the network. It was least likely for private/for profit organizations, medical practitioners, professional organizations, and media to be connected to Childhood Obesity Prevention network members.

- *Prioritize connections between organizations to which RWJF should be connected.*

A list of organizations that RWJF should be connected to is presented in Exhibit 25, pp. 89-91 (abbreviated) of the main report. A full list contains about 500 names, and sixty-four organizations were cited by at least three survey respondents as important future targets for RWJF to be connected to. It is likely that many or most names and organizations that respondents identify are already well-known to RWJF. The frequency, with which targets are suggested, however, may provide further guidance to RWJF.