

Doris Duke Fellowships Social Network Analysis Report: July 2019–June 2020

Colleen Schlecht

Deborah Daro

Lee Ann Huang

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Contact

Colleen Schlecht, Researcher, cschlecht@chapinhall.org

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EXECUTIVE SUMMARY

Established in 2010, the Doris Duke Fellowships for the Promotion of Child Well-Being focus on identifying and nurturing 15 promising doctoral students from multiple disciplines each year. The program engages fellows for 2 years to collectively address child well-being by applying research-based solutions to policy and practice challenges. The fellowships' ongoing implementation is guided by three core operational objectives:

- Selecting individuals with the skills, passion, and institutional support necessary to sustain long-term professional involvement in the child well-being field.
- Selecting cohorts of fellows that collectively represent a diverse group of scholars in terms of their disciplines, research interests, backgrounds, and technical expertise.
- Creating an active, self-generating learning network among the fellows through ongoing web-based conferences, annual meetings, informal meetings at relevant national conferences, peer mentoring, and shared research projects.

For the past 5 years, we have surveyed current and graduated fellows regarding the strength of the network both within and across cohorts. This report summarizes the results of our most recent survey of the fellowships' eight cohorts. The survey asked about connections made between July 2019 and June 2020. One-third of this data observation period overlaps with the first 4 months of the global COVID-19 pandemic. Changes were instantly and comprehensively implemented as to how, and how frequently, people could connect with one another. For the fellowships, in addition to canceling fellowships' meetings, conferences around the world were cancelled. Meanwhile, the fellowships program was undergoing a planned shift as it prepared to transition to become the Child Well-Being Research Network. Therefore, for the first time in data collection, no new cohort was introduced. Despite these changes and barriers to interaction, the network continued to serve its members and members experienced high-quality connections.

Methods

We use social network analysis to measure and map the connections among fellows and the relative strength of these connections. Each fellow is asked to document the number of virtual and in-person contacts they have had with other fellows during the data collection period. Data were collected through a web-based survey distributed to all 120 fellows in the fellowships network.¹ We analyzed the data and created graphs using Node XL Pro, an open-source network analysis extension for Microsoft Excel. A total of 110 fellows responded to the survey (92%). Ten fellows did not complete the survey.²

¹ We used REDCap (Research Electronic Data Capture) for survey distribution.

² Two fellows each from Cohorts Two and Three, three fellows from Cohort Four, and one fellow each from Cohorts Five, Six, and Eight did not complete the survey, which will result in a lower total reported connections for these cohorts compared to what actually occurred.

In this report, we first describe connectivity within each cohort. We then focus on the connections across the full network. We also present the results of a multivariate analysis that assessed the degree to which various factors accounted for variation in a fellow’s total number of connections. The report concludes with a summary of key trends and implications for the newly launched Child Well-Being Research Network.

Key Within-Cohort Findings

We continue to see variance in how fellows are connected to one another within their cohorts, as seen in Table 1. Highlights from the within-cohort analysis include:

- The COVID-19 pandemic likely played an important role in the decline in connectivity for nearly all cohorts this year.
- Despite this, fellows in half of the cohorts reported connecting with at least half of the other fellows in their cohort, although there was wide range (13% to 73%).
- One of our primary indicators of a cohort’s interactions is its *graph density*, which indicates the degree to which all of the possible connections among the 15 fellows in a cohort were made. Once again, cohorts varied widely in graph density, and we see cohorts were impacted by the pandemic differently.
- Reported quality of the connections also varied widely, and cohorts that were both well connected (Cohorts One and Seven) and Cohorts not as connected this year (Cohorts Two and Three) reported the highest quality connections between cohort peers.

Table 1. Summary of Within-cohort Connections

Cohort	One	Two	Three	Four	Five	Six	Seven	Eight
Average number of within-cohort peers fellows connected with	8	4	6	5	6	8	7	8
% of cohort connecting with at least 50% of cohort peers	73%	13%	20%	27%	40%	67%	60%	53%
Overall cohort density	53%	31%	41%	35%	41%	54%	50%	56%
Density trend from previous year	+2%	-13%	-32%	-23%	-36%	-14%	-35%	+90%
Average quality rating of within-cohort connections (scale: 1 to 5)	3.5	3.7	3.3	2.9	3.0	2.9	3.9	3.2

Key Cross-Cohort Patterns

As we observed in the within-cohort analysis, there is variation in each cohort’s connectivity with the full network. The COVID-19 pandemic played a significant role in the number and quality of network connections. In total, 75% of fellows reported connecting with fewer fellows, and 71% reported their connections occurred less frequently with fellows, because of the COVID-19 pandemic. In addition:

- The network reported 2,192 total connections, which is a 37% decrease from the year prior.
- The majority of the 2,192 reported connections (1,338, or 61%) in 2019–20 were reciprocated connections, meaning that both fellows in an interaction recorded the same type of connection. Our best estimate of the number of unduplicated connections this year is 1,523.
- Compared to the prior year, five of eight cohorts increased the proportion of their total connections occurring within their cohort. One cohort maintained the same proportion of within- vs. across-cohort connections. The other two cohorts increased their proportion of across-cohort connections.
- Throughout the network, 61% of all connections crossed disciplinary boundaries and 69% of all reported connections involved fellows from different cohorts. These data show that the network functions as one cohesive network rather than as eight distinct cohort networks or as siloed discipline mini-networks.
- Despite overall declines in connectivity, given the context of the year, the quality of connections greatly increased this year, with 50% of all connections that occurred reported as being high quality (a 25% increase from the prior year).

Multivariate Analysis

We conducted hierarchical multiple regression analysis to identify the most salient factors in explaining variation in the number of connections fellows reported with other fellows. Our independent variables included:

- average connectivity: the average connection to the network in the four prior survey years for each fellow;
- discipline density: number of fellows who shared the same discipline; and
- length in fellowships: number of years each fellow had been in the fellowships.

Average connectivity from 2016 through 2019 explained 66% of the variance in the number of connections in the most recent survey. Not surprisingly, a fellow's average number of connections in prior surveys strongly predicted the number of connections reported in the current survey. Connections breed connections—in a year when connecting was made considerably more difficult, previously established relationships were significant in determining who was connected this year. Adding the length of time a fellow had been enrolled in the fellowship and whether she was in social work increased the predictive strength of the model, but only slightly (3% and 1% respectively).

Conclusion

The eight cohorts in the Doris Duke Fellowships for the Promotion of Child Well-Being represent a diverse group of emerging scholars. Through participation in activities during their 2-year fellowships term and subsequent access to the full fellowships network, these scholars have the opportunity to collaborate within and across cohorts, disciplines, and small groups. The network

survey found that substantial interactions occur between the fellows, both within and across cohorts, beyond interactions at fellowships events. Perhaps most importantly, this survey year showed us the network can sustain itself in a virtual world, in large part due to the investment fellows made early on to develop professional and personal connections. Key themes include:

100% of all fellows are connected to the network. Despite a drop in total connections and density, and 10 fellows not completing the survey, all fellows are engaged in the network. The length of time away from the fellowships and the effects of the pandemic did not cause any fellows to drop from the network.

Fellows seek high-quality connections. The vast majority of connections that had more than one interaction throughout the year were rated as high quality. All cohorts but one reported a higher proportion of high-quality connections this year compared to the prior year. This rating is considerable given 62% of all connections occurred virtually during the survey year, and virtual connections are not as commonly given high-quality ratings as in-person connections.

Establishing strong ties early in the network allows for sustained connections. The pandemic impacted connections, but the network sustained and, in some ways, thrived. Having a friend or social relationship drives connections, and these connections continued despite the global pandemic. Fellowship strategies from the onset helped develop and strengthen ties between fellows, and these existing ties proved critical to maintaining connections during the pandemic and in an all-virtual world. Moving forward, this has implications for strategies the new Child Well-Being Research Network should consider in order to establish strong early connections between network members.

INTRODUCTION

The Doris Duke Fellowships for the Promotion of Child Well-Being, established in 2010, supports scholars and young professionals who dedicate their work to creating effective responses to the myriad challenges facing the child abuse prevention field. Over the course of the 10 years of the program, we selected 120 fellows from diverse disciplines across eight cohorts for 2-year program terms. During the 2 years, fellows have certain expectations for engagement; after the 2 years, fellows are considered graduated fellows and remain part of the fellowships network. The program's implementation is guided by three core operational objectives:

- Selecting individuals with the skills, passion, and institutional support necessary for sustaining long-term professional involvement in the child well-being field.
- Selecting cohorts of fellows that collectively represent a diverse group of scholars in terms of their backgrounds, disciplines, research interests, and technical expertise.
- Creating an active, self-generating learning network among the fellows through ongoing web-based conferences, annual meetings, informal meetings at related national conferences, peer mentoring, and shared research projects within small groups of fellows.

Since 2016, we have surveyed current and graduated fellows about their connections with other fellows, both within and outside their cohorts. Each year we have used the same instrument. However, along with nearly every facet of our lives, this year looked entirely different than any other. One-third of the data observation period, July 2019–June 2020, overlapped with the first four months of the global COVID-19 pandemic. As changes were being made around the world in terms of how people work, live, and interact with each other, the fellowships program also quickly pivoted. In addition to canceling fellowships meetings, conferences around the country were cancelled, and people were forced to hit pause on many professional activities. Meanwhile, the fellowships program was undergoing a planned shift as it prepared to transition to the new Child Well-Being Research Network. Therefore, for the first time in our fellowships survey, no new cohort had been introduced to the network, and only one cohort served as an active cohort. Despite these changes and barriers to interaction, the network continued to serve its members and its members experienced high-quality connections.

This report details the findings from the most recent survey year (July 2019–June 2020), while providing a look at some trends over the 5 years of survey administration. Repeating the survey each year allows us to assess the frequency and quality of interactions fellows enjoy with their colleagues while in the program, and assess the extent to which these relationships are sustained over time.

METHOD

According to the International Network for Social Network Analysis (SNA), network analysis is “based on the intuitive notion that these patterns are important features of the lives of the individuals who display them. Network analysts believe that how an individual lives depends in large part on how that individual is tied into the larger web of social connections” (Freeman, n.d.). Unlike other approaches, “the fundamental distinction of social network analysis research is that relationships—who is connected to whom—are of paramount importance in explaining behavior. . . network analysis offers many exciting tools and techniques useful in research” (Valente, 2010, p. vii-viii). Because social network analysis emphasizes the importance of relationships to explain behavior, we use this method to look at the relationships formed in, and because of, the fellowships as well as the strength of such connections.

In this report, we use social network analysis to illustrate the extent to which fellows within a given cohort communicate with others in their cohort and examine what factors—such as academic discipline or membership in the same small group (as a proxy for early shared research interests)—lead to greater, more frequent interactions.³ We also examine relationships across the eight cohorts and how connected each cohort is to the network as a whole. In considering cross-cohort interactions, we consider the role academic discipline may play in connecting fellows and the quality of connections. To visually illustrate these interactions, we developed networking graphs for each individual cohort as well as for the full sample. Graphs were created using NodeXL Pro, an open-source network analysis extension for Microsoft Excel.

Data Collection

Data were collected through a web-based survey distributed to all 120 fellows in the fellowships network.⁴ Using this survey, fellows reported the number and type (for example, in-person, phone, email) of interactions they had with other fellows, both within and outside their cohort, between July 2019 and June 2020. A total of 110 fellows responded to the survey (93%). Ten fellows did not complete the survey.⁵ Additionally, three fellows who completed the survey did not report a single connection during the reporting year. However, other respondents reported at least one connection with these 13 fellows, and so based on these data, all fellows are considered “engaged” in the network. We acknowledge that the level of this engagement and our ability to fully assess engagement rates is uneven.

When reporting contact with another fellow, each respondent indicated the frequency of the in-person and virtual contact they had during the study year with every other fellow, on a 6-point

³ Upon entering the fellowships program, fellowships staff assign five fellows from each cohort into one of three small groups within that cohort. Fellows in each group share similar research interests but are assigned to ensure diversity within the group on a variety of domains, including discipline, geography, and demographic characteristics.

⁴ We used REDCap (Research Electronic Data Capture) for survey distribution.

⁵ Two fellows from Cohort Two, two from Cohort Three, three from Cohort Four, one from Cohort Five, one from Cohort Six and one from Cohort Eight did not complete the survey, which will result in a lower total reported connections for these cohorts compared to what actually occurred.

scale: 0 = no contact; 1 = single contact; 2 = 2–5 contacts a year; 3 = 6–11 contacts a year; 4 = 12–23 contacts a year; and 5 = 24 or more contacts a year. Consequently, we are unable to report the specific number of contacts between individual pairs of fellows. Respondents also rated the average quality of the contacts with each fellow on a 5-point scale from 1 (a weak, short connection) to 5 (a strong, lengthy connection).

In recording their contact with other fellows, respondents from Cohort Eight were asked **not** to include interactions that occurred during the required fellowships meeting that took place in the fall of 2019, and **not** to include connections made discussing their small group project work. As such, the level of contact reported in this document for Cohort Eight reflects the minimal level of contact outside of mandatory fellowships interactions among current fellows during 2019–20.

When two fellows report a connection with each other of the same type (whether virtual or in person), we count that as two connections. We call this a reciprocated connection. For example, if Fellow A reports an in-person connection with Fellow B, and Fellow B reports an in-person connection with Fellow A, that is counted as two connections in the total number of connections. The graphs in this report display connections using the highest frequency and average quality reported between the pair.

When only one fellow reports a connection with another fellow of a certain type (in person or virtual), we count that as one connection. For example, if Fellow A reports an in-person connection with Fellow B, but Fellow B does not report an in-person connection with Fellow A, that is counted as one connection in the total number of connections.

Key for Networking Graphs

In developing graphs, we utilized a number of techniques to make the data and their implications more accessible to the reader. The variation in both the width and darkness of the lines between two given fellows reflects variation in the frequency and reported quality of these interactions. The *width* of each line indicates the frequency of the reported in-person or virtual contacts between two fellows; the broader the line, the greater the number of contacts. The *darkness* of each line indicates the average reported quality of all of the in-person or virtual connections between two fellows; the darker the line, the higher the reported quality. A fully opaque line of a darker color signifies connections of the highest quality. The variation in the color and type of lines reflects the variation in the type of connection reported. *Solid, steel blue* lines represent in-person connections. *Dashed, grey* lines represent virtual connections. Virtual and in-person connections frequently overlap, indicating that fellows reported both types of connections.

Social Network Analysis Terminology

Throughout this report, we use terminology commonly employed in reporting network analysis. These terms and related definitions are noted below.

- **Edges** are the connections between individuals within a social network. In our network, edges code *in-person* (solid, steel blue lines) or *virtual* (dashed, grey lines) connections between fellows.
- **Vertices** are the individuals that make up a social network. In our network, the vertices are the fellows.
- **Degree** denotes the number of direct connections of each vertex (i.e., fellow) in the network. In our report, it is the number of other fellows an individual has connected with during the year (*not* the number of times they connected with other fellows). Fellows with the highest degree are communicating with the greatest number of other fellows in the network.
- **Retention rate** is a measure of the vertices (fellows) within a cohort that have connected with at least half of their cohort peers during the survey period. Because each fellow has 14 peers in their cohort, a fellow is considered *retained* in their cohort network if their number of degrees is seven or higher—meaning they connected with seven or more other fellows in their cohort. The rate is calculated by dividing the total number of fellows in a network (15 for each cohort) by the number retained in that network and converting to a percentage.
- **Graph density** is the ratio between the number of edges (connections between fellows) in the graph and the total number of possible edges available in the network (if each fellow interacted virtually and in person with all of the other fellows in network). Thus, the higher the graph density, the higher the percentage of possible connections captured within the graph.
- **Betweenness centrality** indicates the power of a vertex (a fellow) to broker connections between other fellows within the network. Thus, fellows with a high betweenness centrality are essential to the connectivity of the network, even if they do not have the highest degree. These fellows are most essential for connecting to fellows who are not accessing the network through other connections with fellows.

FINDINGS

Summary of Within-Cohort Connections

Cohort Findings

Cohort One

By the numbers

Network Density: 0.53

Average Degree: 7.5

Retention Rate: 73%

Consistently strong, connected cohort

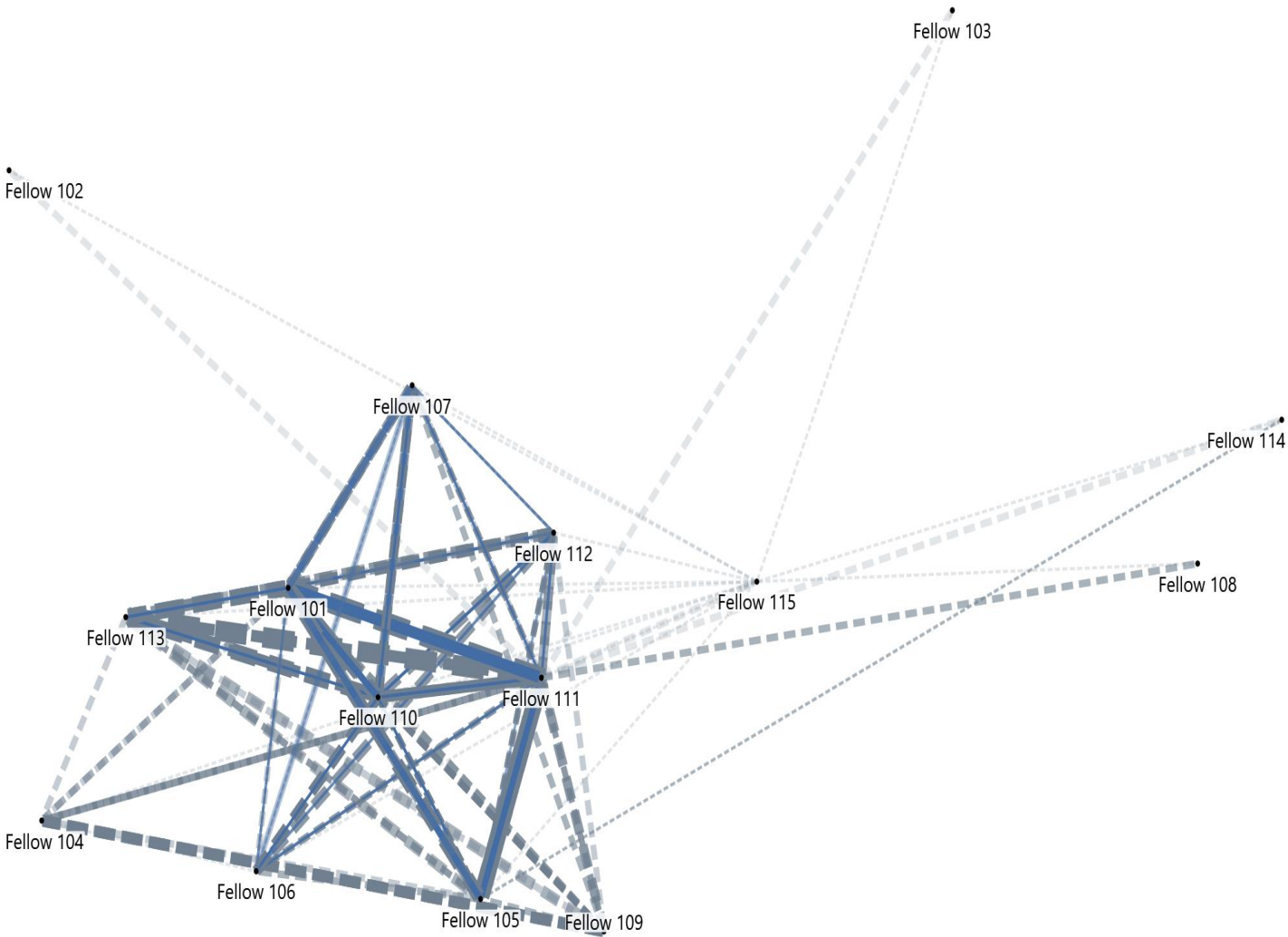
Cohort One was selected in 2011 and remains one of the most cohesive cohorts, with consistently high levels of engagement between cohort peers. All 15 Cohort One fellows completed the survey and were active within their cohort during the survey year, for a 100% response rate and 100% participation in the cohort network. During 2019–20, the connectivity between Cohort One fellows improved in overall density, average degree, and retention rate. And despite a drop in total number of connections, the quality of these connections remained high. In addition, Cohort One fellows reported 26% more connections with each other than any other cohort (see Table 9). Throughout the past 5 years, two-thirds of the cohort ($n = 10$) connected with at least half of their cohort peers, and this year 11 members of the cohort (73%) connected with at least half of their peers. Additionally, throughout the 5 years, 53% of all possible connections took place, which was among the highest of all cohorts.

Table 2. Cohort One Within-cohort Connectivity across Five Survey Years

	2019–20	2018–19	2017–18	2016–17	2015–16
Total no. of connections	121	162	143	146	129
Retention rate	73%	67%	67%	67%	67%
Network average degree	7.5	7.3	7.9	7.6	7.2
Cohort density	0.53	0.52	0.60	0.63	0.69
Average quality rating	3.5	3.6	3.5	3.7	3.6
Median quality rating	4	4	4	4	3

Figure 1 graphs the connections among Cohort One fellows for 2019–20, with the nodes labeled by a unique ID. The graph shows a cohesive network, with most fellows central to the network and only a handful of fellows on the periphery. The wide lines show connected fellows often interacted more than once during the course of the year, while the dark lines indicate these interactions were high quality.

Figure 1. Cohort One Network Connections, 2019-20



Notes:

- Dashed, grey lines represent virtual interactions; solid, steel blue lines indicate in-person interactions.
- The width of the line shows the total number of in-person and virtual interactions between two fellows. The broader the line, the greater the number of interactions.
- The darkness of the line shows the average reported quality of all interactions between two fellows. The darker the line, the higher the reported quality.

Cohort Two

By the numbers

Network Density: 0.31

Average Degree: 3.7

Retention Rate: 13%

Consistently less connected, though higher quality among those engaged

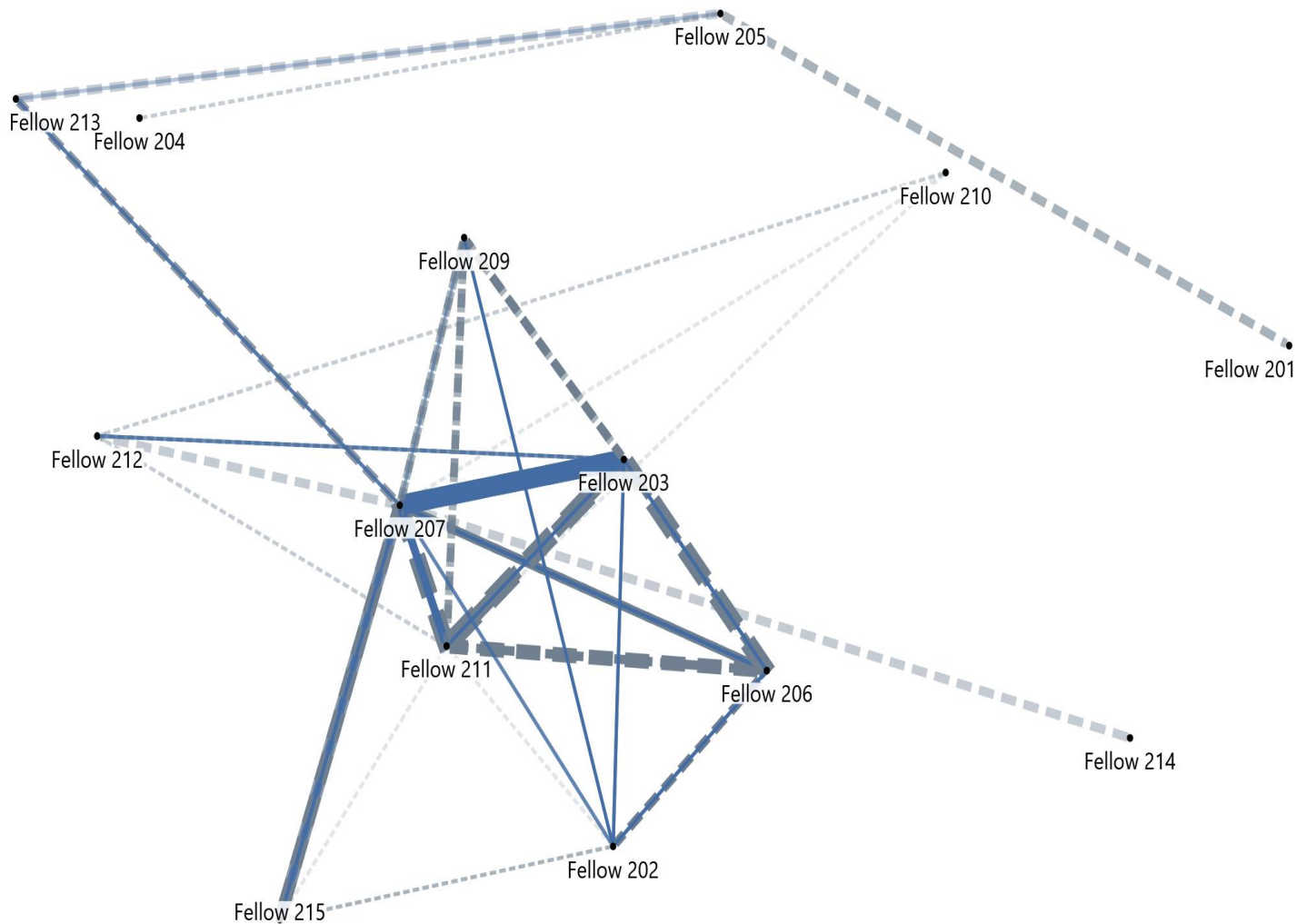
Cohort Two was selected in 2012 and has continued to struggle in sustaining frequent and strong connections among its members. As in prior surveys, Cohort Two reported a lower than average number of connections, cohort density, and average degree and retention rate among cohort fellows, compared with other cohorts (see Table 2). Thirteen cohort members completed the survey, for an 87% response rate. Fourteen fellows were active within the cohort, meaning at least one connection was reported by 14 of the 15 fellows, for a 93% participation rate in their cohort network. The quality of connections remains high, with the average quality rating of this year's connections second highest among all cohorts (see Table 9). The cohort network has been consistently driven by a core group of members, as shown in Figure 2.

Table 3. Cohort Two Within-cohort Connectivity across Five Survey Years

	2019–20	2018–19	2017–18	2016–17	2015–16
Total no. of connections	59	66	48	51	79
Retention rate	13%	27%	7%	7%	27%
Network average degree	3.7	4.6	3.3	3.2	4.7
Cohort density	0.31	0.35	0.30	0.36	0.39
Average quality rating	3.7	3.7	4.0	3.8	3.7
Median quality rating	4	4	5	5	4

Figure 2 graphs the connections among Cohort Two fellows for 2019–20, with the nodes labeled by a unique ID. Cohort Two has a core group of well-connected fellows (fellows 206, 207, 203, and 211) who comprise the center of the network and engage in frequent and high quality interactions with each other. Fellow 207, along with Fellows 213 and 205, are the most critical for keeping periphery network members engaged, as evidenced by their connections with the nodes on the edge of the graph.

Figure 2. Cohort Two Network Connections, 2019–20



Notes:

- Dashed, grey lines represent virtual interactions; solid, steel blue lines indicate in-person interactions.
- The width of the line shows the total number of in-person and virtual interactions between two fellows. The broader the line, the greater the number of interactions.
- The darkness of the line shows the average reported quality of all interactions between two fellows. The darker the line, the higher the reported quality.

Cohort Three

By the numbers

Network Density: 0.60

Average Degree: 8.4

Retention Rate: 67%

Experienced large drop in connectivity

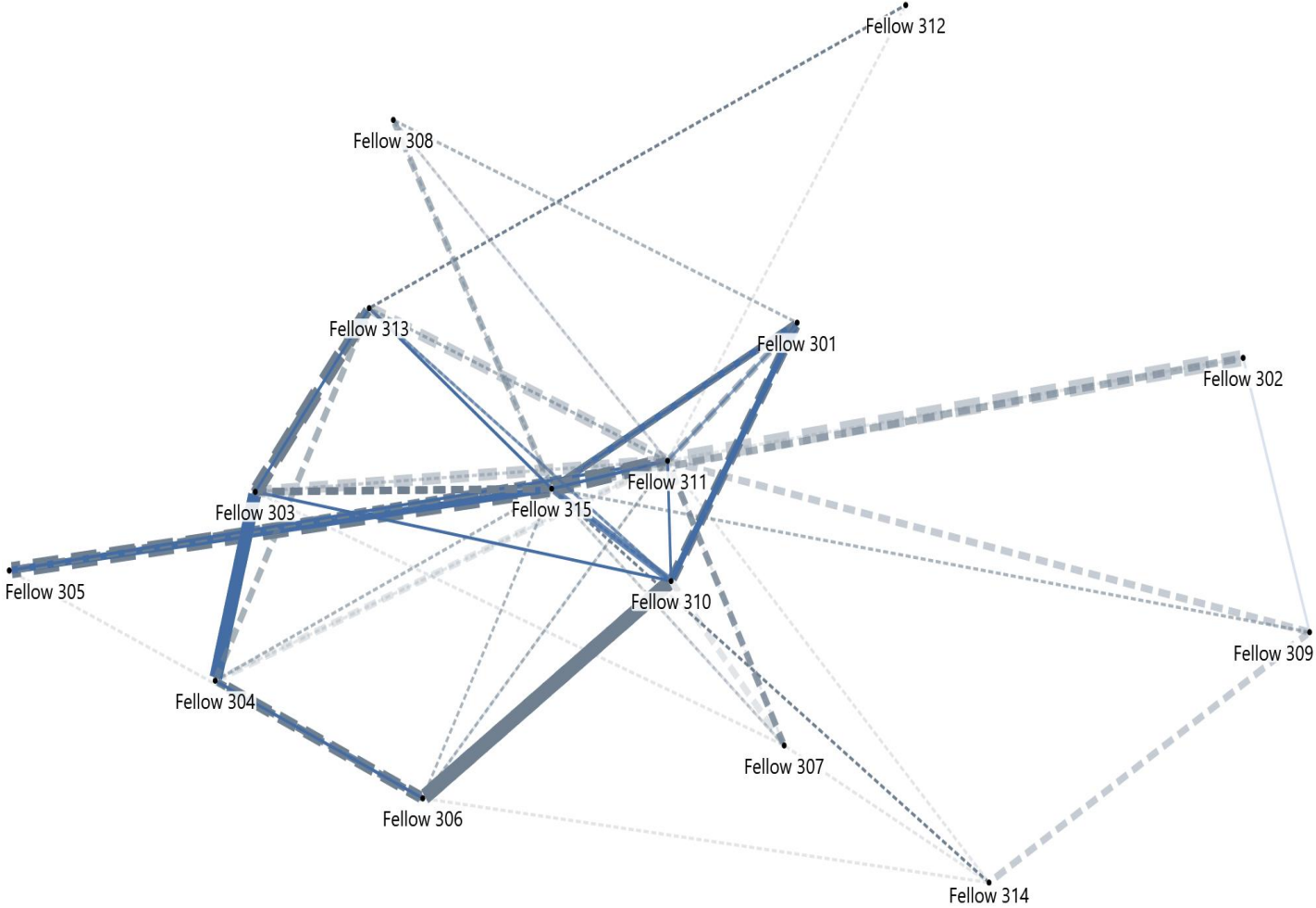
Cohort Three experienced their lowest connectivity numbers during the most recent survey year (see Table 3). Thirteen cohort members completed the survey, for an 87% response rate; however, all fellows participated in the network (through either reporting a connection, or a cohort peer reporting an interaction with them in their survey response). The total number of reported connections between cohort members dropped 30% this year compared to last year, and the number of fellows connecting with at least half of their cohort peers was at an all-time low (3 out of 15). While the average quality of all connections rose slightly from the previous year, Cohort Three ranks in the middle of all cohorts in how they rate their interactions with each other (see Table 9).

Table 4. Cohort Three Within-cohort Connectivity across Five Survey Years

	2019–20	2018–19	2017–18	2016–17	2015–16
Total no. of connections	82	117	103	139	91
Retention rate	20%	67%	47%	67%	33%
Network average degree	5.7	8.4	6.7	7.6	6.3
Cohort density	0.41	0.60	0.48	0.54	0.45
Average quality rating	3.3	3.0	3.7	3.8	4.1
Median quality rating	3	3	4	4	5

Figure 3 graphs the connections among Cohort Three fellows for 2019–20, with the nodes labeled by a unique ID. The graph displays two fellows in the center of the network (Fellows 315 and 311), with connections to nearly all other fellows in the cohort. These two are also most critical to keeping more peripheral members engaged in the network.

Figure 3. Cohort Three Network Connections, 2019–20



Notes:

- Dashed, grey lines represent virtual interactions; solid, steel blue lines indicate in-person interactions.
- The width of the line shows the total number of in-person and virtual interactions between two fellows. The broader the line, the greater the number of interactions.
- The darkness of the line shows the average reported quality of all interactions between two fellows. The darker the line, the higher the reported quality.

Cohort Four

By the numbers

Network Density: 0.35

Average Degree: 4.9

Retention Rate: 27%

Declining connectivity in recent years

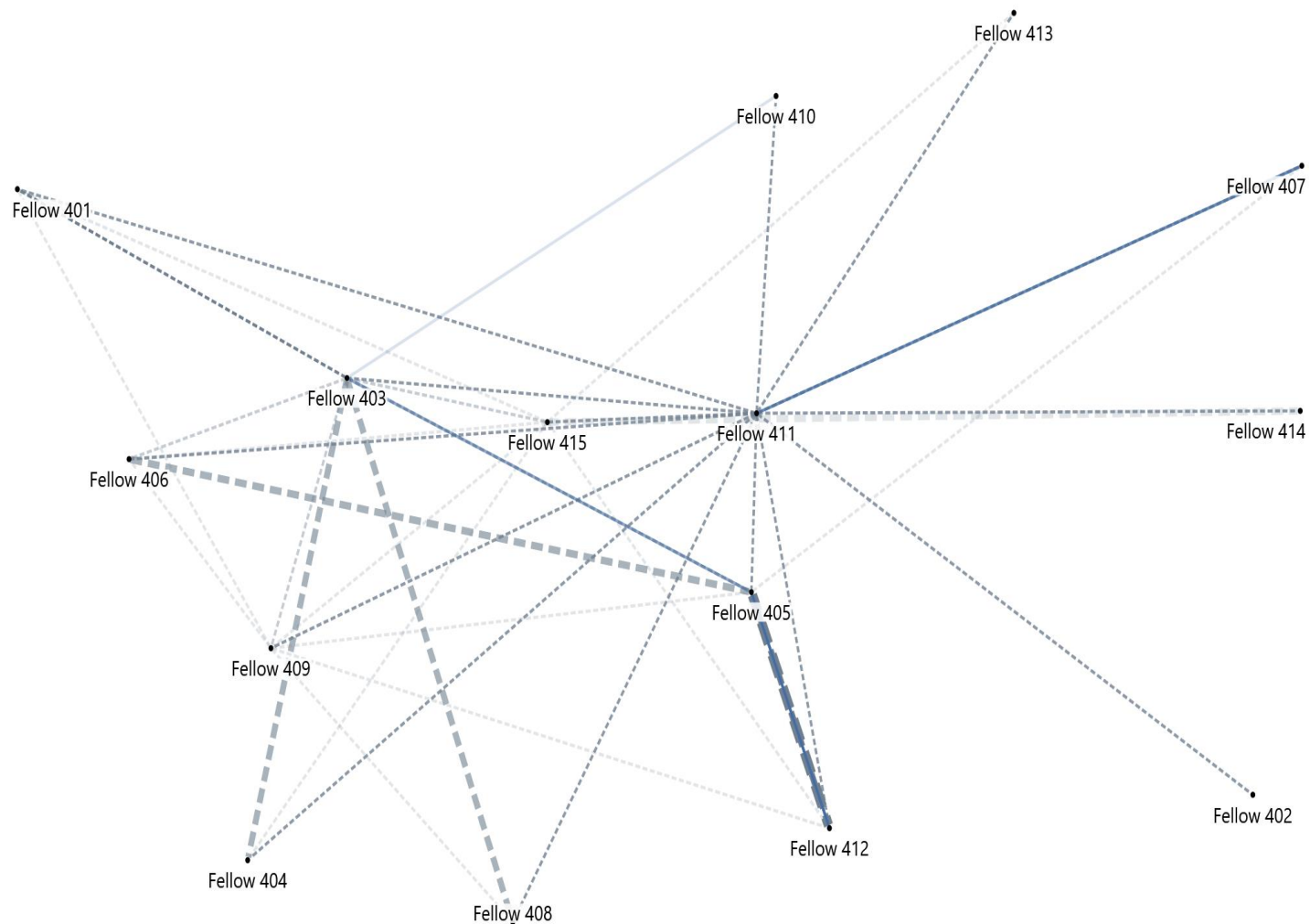
Cohort Four was selected in 2014. This cohort has experienced some ebbs and flows with their connectivity over the past five years, which includes their final year as active fellows and four years as alumni (see Table 4). Cohort Four had the lowest response rate among all cohorts, with 12 fellows (80%) completing the survey. However, all 15 fellows or their peers reported connections, for a 100% participation rate in their cohort network. Only four fellows connected with at least half of their cohort peers this year, an all-time low. Additionally, the total number of connections between Cohort Four fellows has now fallen for 2 consecutive years, and has dropped by more than 50% in the past 2 years. Average degree and cohort density has been on a consistent decline since the cohort's time as active fellows. The average quality rating of all interactions remains relatively low, though this year's ratings were highest among all of their alumni years.

Table 5. Cohort Four Within-cohort Connectivity across Five Survey Years

	2019-20	2018-19	2017-18	2016-17	2015-16
Total no. of connections	42	67	91	84	146
Retention rate	27%	33%	67%	47%	100%
Network average degree	4.9	6.4	6.9	7.1	10.7
Cohort density	0.35	0.46	0.50	0.51	0.76
Average quality rating	2.8	2.1	2.5	2.7	3.5
Median quality rating	3	2	3	2	4

Figure 4 graphs the connections among Cohort Four fellows for 2019-20, with the nodes labeled by the fellow's discipline. Among the 42 connections, only five were in person this past year, shown by the very few blue lines. One fellow (Fellow 411) sits at the center of this network and is connected with all their cohort peers. This fellow plays a critical role in keeping this network connected. Overall, the graph shows fewer interactions between the connections and lower quality connections than other cohort graphs.

Figure 4. Cohort Four Network Connections, 2019–20



Notes:

- Dashed, grey lines represent virtual interactions; solid, steel blue lines indicate in-person interactions.
- The width of the line shows the total number of in-person and virtual interactions between two fellows. The broader the line, the greater the number of interactions.
- The darkness of the line shows the average reported quality of all interactions between two fellows. The darker the line, the higher the reported quality.

Cohort Five

By the numbers

Network Density: 0.41

Average Degree: 5.7

Retention Rate: 40%

Traditionally active cohort, within-cohort connectivity considerably declined this year

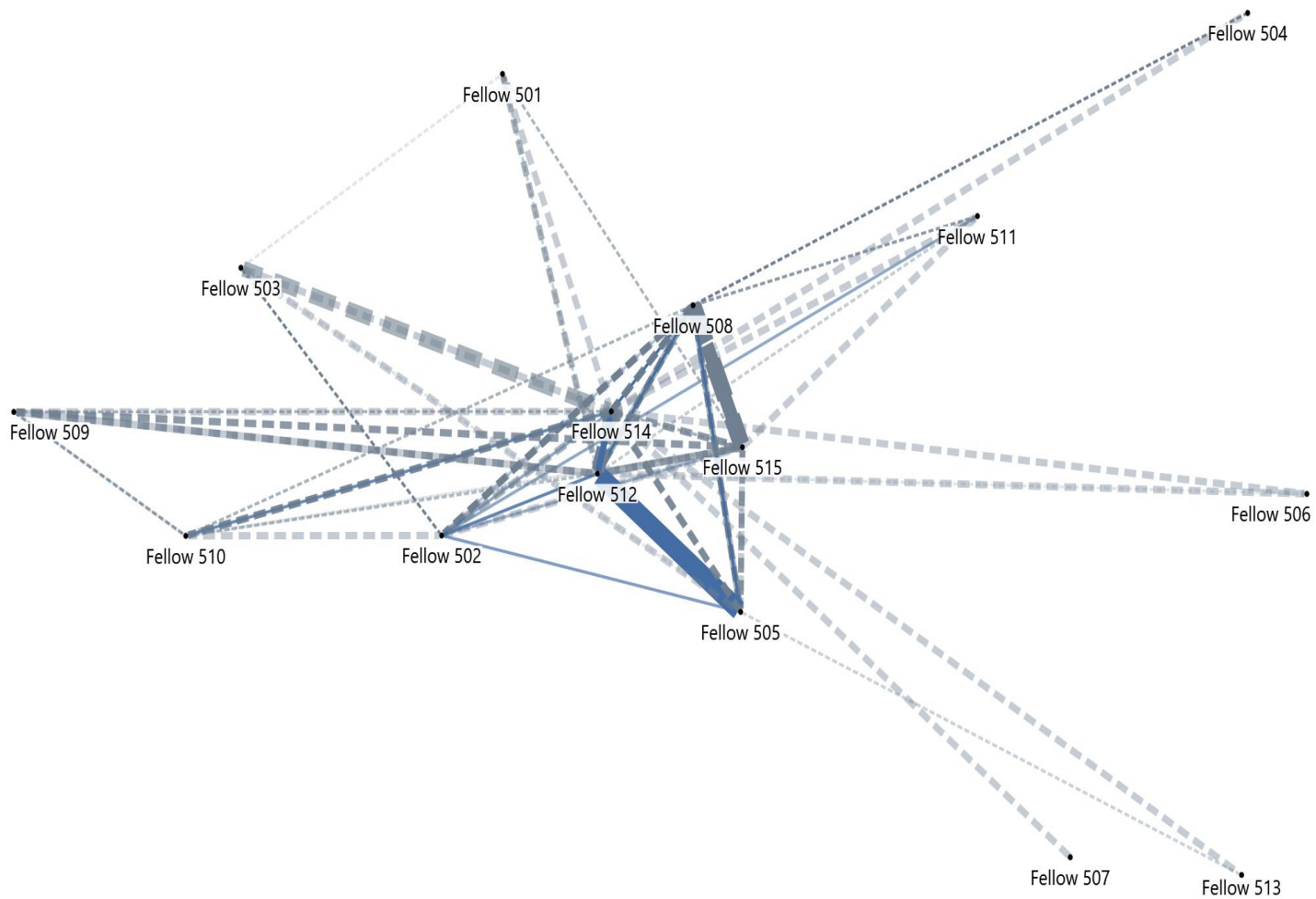
Cohort Five was selected in 2015 and had low levels of connectivity during their first year in the fellowships. However, the cohort reported increasingly higher connectivity over the next 3 years, with last year's numbers nearly doubling the previous year. This year, however, connectivity numbers were similar to previous, lower levels. Fourteen fellows completed the survey, for 93% response rate, but all fellows were active in the cohort during the survey year for a 100% participation rate in the cohort network. Numbers across all connectivity measures dropped sharply this year, including the average quality rating of all interactions, which reached its lowest in Cohort Five's survey history.

Table 6. Cohort Five Within-cohort Connectivity across Five Survey Years

	2019–20	2018–19	2017–18	2016–17	2015–16
Total no. of connections	79	153	105	104	62
Retention rate	40%	80%	40%	67%	27%
Network average degree	5.7	8.9	5.5	7.7	5.5
Cohort density	0.41	0.64	0.39	0.55	0.39
Average quality rating	3.0	3.6	3.5	3.2	3.3
Median quality rating	3	4	3	3	3

Figure 5 graphs the connections among Cohort Five fellows for 2019–20, with the nodes labeled by a unique ID. The graph shows a core group of fellows making up the center of the network and connecting with most of their cohort peers (Fellows 515, 514, 512, and 508). Fellow 514 also plays the key connector role in this network, connecting with each cohort peer during the year. Additionally, fellows who connected often engaged in more than one interaction over the year, as evidenced by the wide lines connecting fellows.

Figure 5. Cohort Five Network Connections, 2019–20



Notes:

- Dashed, grey lines represent virtual interactions; solid, steel blue lines indicate in-person interactions.
- The width of the line shows the total number of in-person and virtual interactions between two fellows. The broader the line, the greater the number of interactions.
- The darkness of the line shows the average reported quality of all interactions between two fellows. The darker the line, the higher the reported quality.

Cohort Six

By the numbers

Network Density: 0.54

Average Degree: 7.6

Retention Rate: 67%

Despite great declines in connectivity, continues to be one of the more connected cohorts

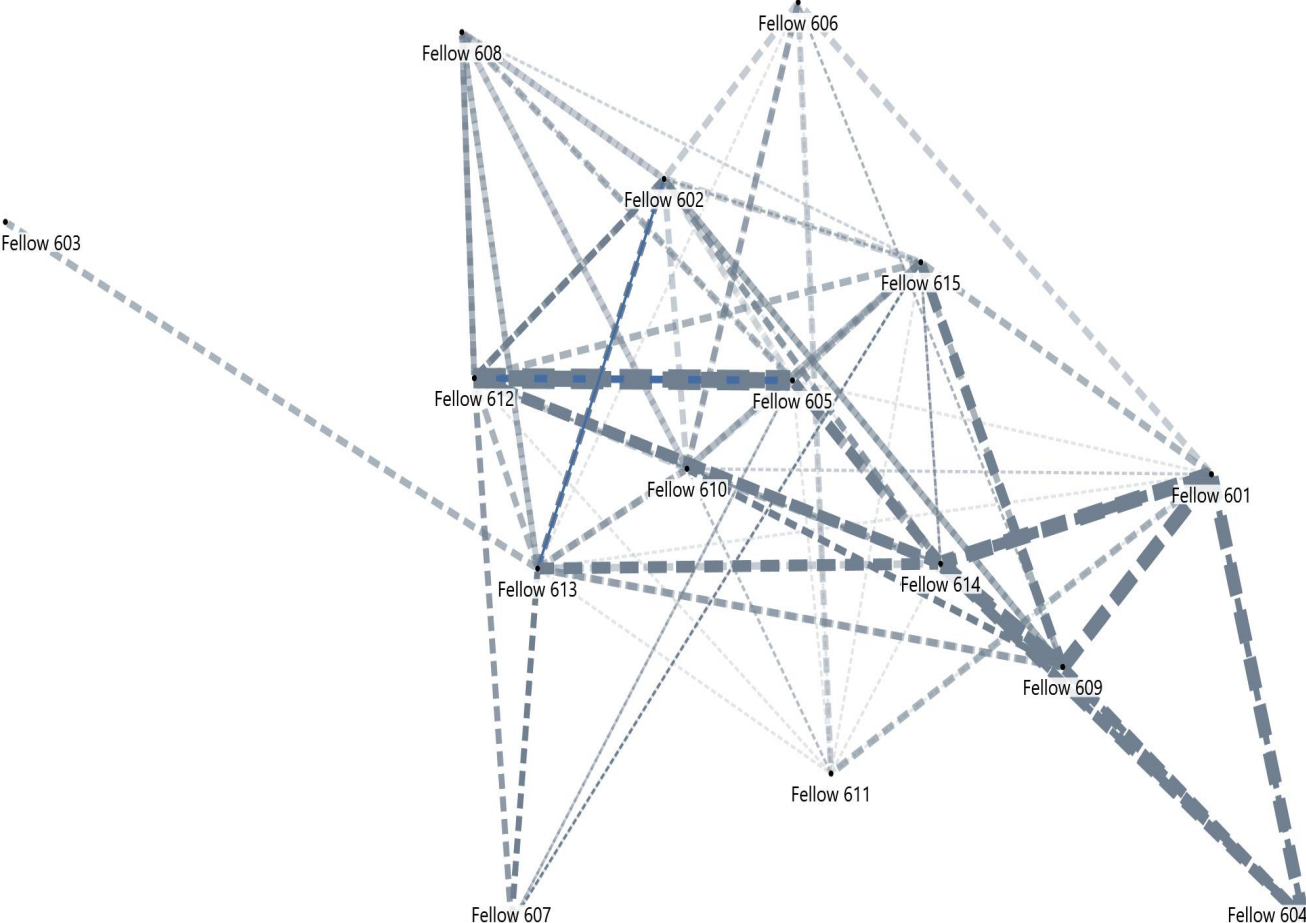
Cohort Six was selected in 2016 and has been a moderately connected cohort. This past year, 14 Cohort Six fellows (93%) completed the survey, and 100% participated in the cohort network during the survey year. Unlike most cohorts, Cohort Six did not experience a decline in connectivity during their first year out of the fellowship (2018–19). However, connections, density, average degree, and average quality rating all dropped in 2019–20 (see Table 6). Additionally, the number of fellows from Cohort Six that connected with at least half of their cohort peers during the year dropped from 13 (in 2018–19) to 10 this past survey year. Despite this year’s challenges, Cohort Six remains a strongly connected cohort compared to others, with their numbers along all connectivity measures either first or second among all eight cohorts (see Table 9).

Table 7. Cohort Six Within-cohort Connectivity across Four Survey Years

	2019–20	2018–19	2017–18	2016–17
Total no. of connections	96	143	142	89
Retention rate	67%	87%	87%	53%
Network average degree	7.6	8.8	9.5	6.7
Cohort density	0.543	0.629	0.676	0.476
Average quality rating	2.9	3.4	4.0	3.7
Median quality rating	3	3	5	4

Figure 6 graphs the connections among Cohort Six fellows for 2019–20, with the nodes labeled by a unique ID. The graph shows more connections, and connections occurring more frequently, relative to other cohort graphs. Among the 96 reported connections, only three were in person during the past year, as shown by the three blue lines in the graph. Several fellows are well connected in this network and few lie on the periphery, indicating that the network is fairly cohesive.

Figure 6. Cohort Six Network Connections, 2019–20



Notes:

- Dashed, grey lines represent virtual interactions; solid, steel blue lines indicate in-person interactions.
- The width of the line shows the total number of in-person and virtual interactions between two fellows. The broader the line, the greater the number of interactions.
- The darkness of the line shows the average reported quality of all interactions between two fellows. The darker the line, the higher the reported quality.

Cohort Seven

By the numbers

Network Density: 0.50

Average Degree: 6.9

Retention Rate: 60%

Large declines in connectivity in first year out of fellowship, consistent with network trends

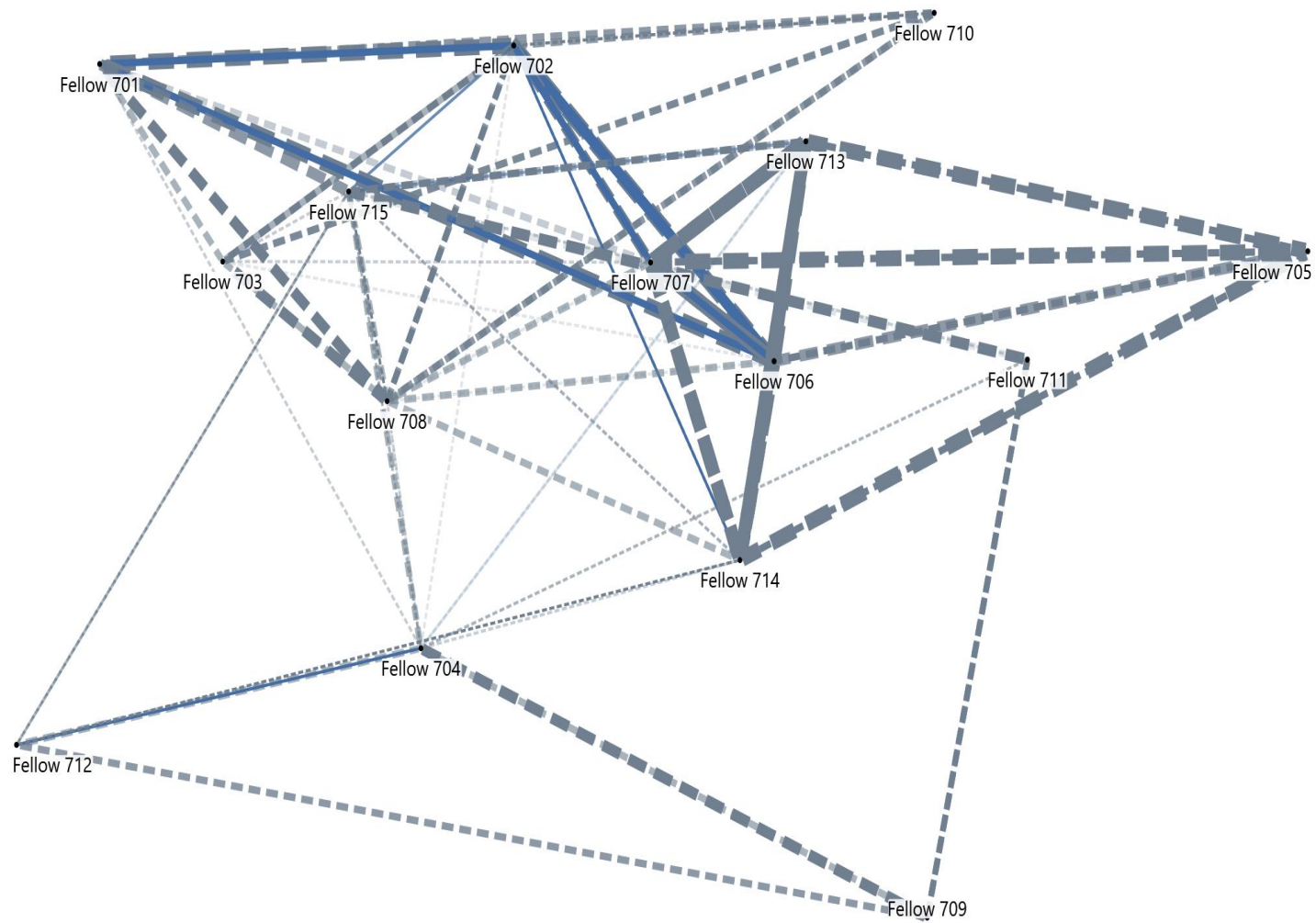
Cohort Seven was selected in 2017, and this survey captured their connections during their first year out of the Fellowships. Traditionally, the first year out has been a year of lower connectivity for most cohorts, and this held true for Cohort Seven during 2019–20. All Cohort Seven fellows completed the survey and were active during the survey year, for a 100% response rate and 100% participation in the cohort network. Despite declines on connectivity measures, Cohort Seven fellows connected with about half of their cohort peers during the year, on average, and 50% of all possible connections that could occur did. Furthermore, Cohort Seven fellows ranked the quality of their within-cohort connections, on average, higher than the two previous years, and higher than any other cohort this year (see Table 9).

Table 8. Cohort Five Within-cohort Connectivity across Three Survey Years

	2019–20	2018–19	2017–18
Total no. of connections	94	184	124
Retention rate	60%	100%	53%
Network average degree	6.9	10.7	7.9
Cohort density	0.50	0.76	0.56
Average quality rating	3.9	3.6	3.5
Median quality rating	5	4	4

Figure 7 graphs the connections among Cohort Seven fellows for 2019–20, with the nodes labeled by a unique ID. The graph shows another well-connected cohort, with a very cohesive group among all cohort fellows. Because of this, no one fellow plays a critical connector role. The wide lines show connections often occurred more than once, and the dark lines in the graph also show high-quality connections between Cohort Seven fellows.

Figure 7. Cohort Seven Network Connections, 2019–20



Notes:

- Dashed, grey lines represent virtual interactions; solid, steel blue lines indicate in-person interactions.
- The width of the line shows the total number of in-person and virtual interactions between two fellows. The broader the line, the greater the number of interactions.
- The darkness of the line shows the average reported quality of all interactions between two fellows. The darker the line, the higher the reported quality.

Cohort Eight

By the numbers

Network Density: 0.56

Average Degree: 7.9

Retention Rate: 53%

Increasing connectivity within and across network in cohort's second year

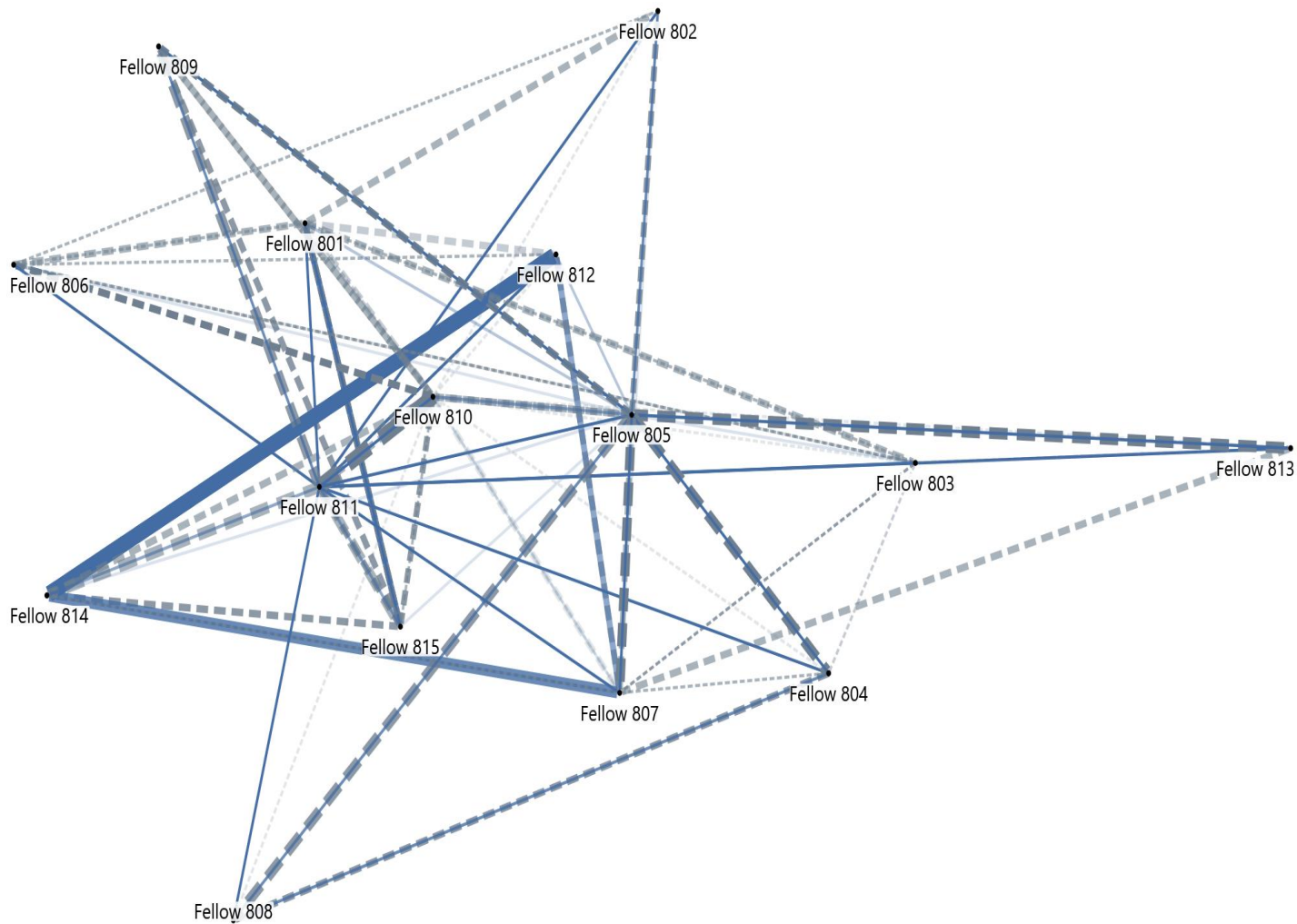
Cohort Eight was selected in 2018 and was in their second year of the fellowships during this survey period. Fourteen Cohort Eight fellows (93%) completed the survey and 100% were active in the cohort network during the survey year. Cohort Eight experienced large gains across all connectivity measures during their second year. In a year that was more difficult to make connections, the cohort found ways to connect and engage with more of their peers than the year prior. The numbers for Cohort Eight are likely an underestimate of the connectivity for the cohort during 2019–20, as they were instructed not to include interactions made while engaged in required fellowships activities.

Table 9. Cohort Eight Within-cohort Connectivity across Two Survey Years

	2019-20	2018-19
Total no. of connections	96	62
Retention rate	53%	13%
Network average degree	7.9	4.1
Cohort density	0.56	0.30
Average quality rating	3.2	3.7
Median quality rating	3	4

Figure 8 graphs the connections among Cohort Eight fellows for 2019–20, with the nodes labeled by a unique ID. The graph shows a very cohesive network, with in-person and virtual connections occurring at higher frequencies and at medium and high quality. Several fellows form the core of the network and connected with each of their cohort peers over the year (Fellows 805, 811, and 810). While these fellows play a connector role, the cohesiveness of the group shows that no one fellow is in high danger of dropping out of the network.

Figure 8. Cohort Eight Network Connections, 2019–20



Notes:

- Dashed, grey lines represent virtual interactions; solid, steel blue lines indicate in-person interactions.
- The width of the line shows the total number of in-person and virtual interactions between two fellows. The broader the line, the greater the number of interactions.
- The darkness of the line shows the average reported quality of all interactions between two fellows. The darker the line, the higher the reported quality.

Within-Cohort Summary

Cohorts have always experienced year-to-year variability in their number of reported connections. Figure 9 illustrates that cohorts' connectivity fluctuates over time and might be influenced by external factors such as career transitions, personal and family changes, and professional demands. All cohorts except Cohort Eight experienced a reduction in reported connections during 2019–20, perhaps due to the pandemic and subsequent cancellation of several fellowships and professional activities. Only Cohort Four shows consistently declining connectivity over time.

Figure 9. Total Connections 2015–16 through 2019–20, All Cohorts

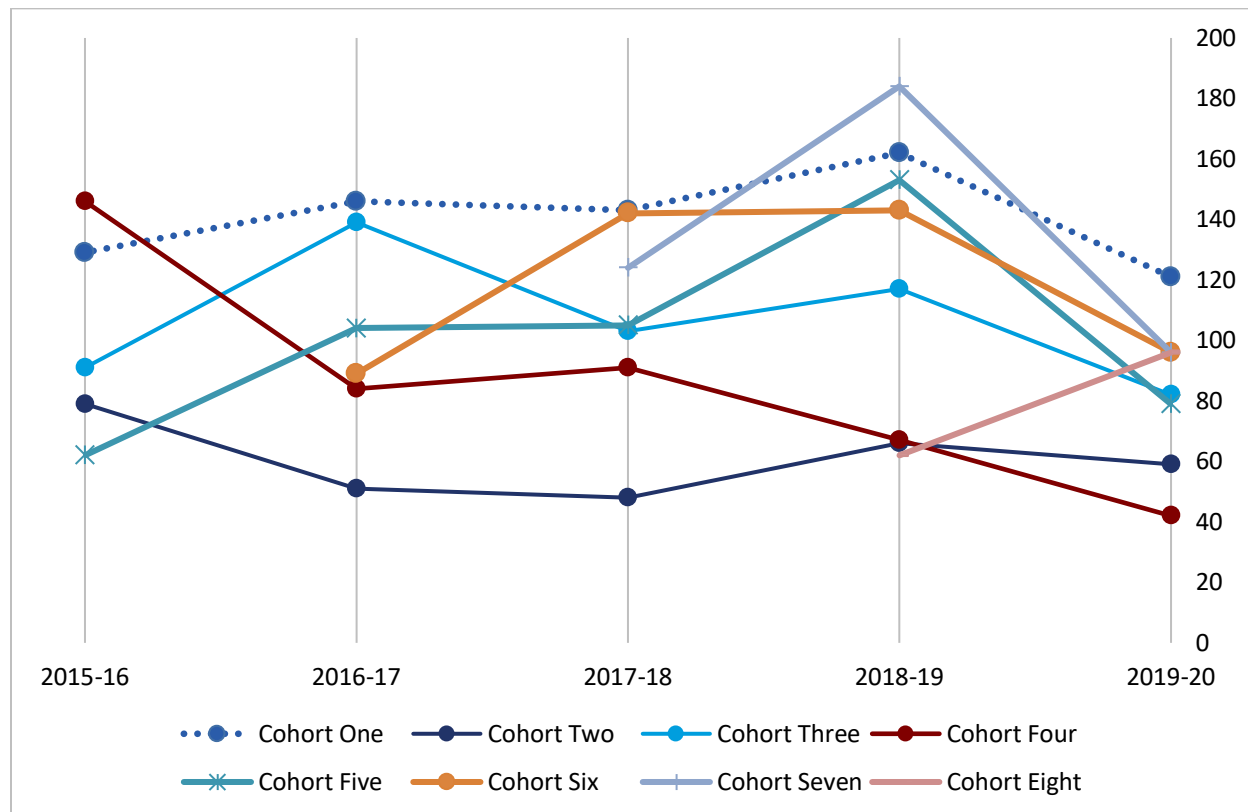


Table 9 summarizes the connectivity of each cohort in 2019–20. As these data illustrate, variation exists between the eight cohorts. Some key points:

- COVID-19 impacted connections. The impact of the pandemic on connections—including cancellation of in-person meetings and conferences around the country and interference with personal connections—likely played an important role in the decline in connectivity for nearly all cohorts this year.
- Quality of connections. While the number of connections declined, the reported quality of the connections that transpired rose this survey year compared to the prior year. This implies that relationships can be sustained even with less frequent and primarily virtual interactions. Building a strong foundation among network members from the onset likely played an important role in quality connections continuing during the pandemic.

- Cohorts continue to vary. Cohorts experience variations over time in their number of connections, their quality of interactions, and their cohort density. Additionally, cohorts vary from each other in terms of who and how many individuals lie at the core of the network. For some cohorts, one or two individuals are the core; other cohorts have a much broader base of fellows that make up the center of the network.

Table 10. Summary of Cohort Connections, 2019–20

	Cohort One	Cohort Two	Cohort Three	Cohort Four	Cohort Five	Cohort Six	Cohort Seven	Cohort Eight
Total no. of connections	121	59	82	42	79	96	96	96
Retention rate	73%	13%	20%	27%	40%	67%	60%	53%
Network average degree	7.5	3.7	5.7	4.9	5.7	7.6	6.9	7.9
Cohort density	0.53	0.31	0.41	0.35	0.41	0.54	0.50	0.56
Median quality rating	4	4	3	3	3	3	5	3

Full Fellowship Network Connections

Overall Connections

The network connectivity for the full fellowships mirrors the patterns we saw in the individual cohorts: connectivity numbers were down while quality ratings rose. In 2019–20, fellows reported a total of 2,192 connections, which is a 37% decline over the previous year (3,493). All cohorts reported a lower number of connections, though declines ranged from 18% (Cohort Eight) to as much as a 52% decline (Cohort Four) in total reported connections. The number of fellows that each fellow reported connecting with ranges between 2 and 69, with an average degree of 19. This is 9 points lower than last year—meaning, on average, fellows connected with 9 fewer individuals this year. The COVID-19 pandemic, and the cancellation of the in-person Mid-Year Meeting, influenced how and how often fellows connected. During 2019–20, 69% of all connections occurred virtually, a 42% increase over the prior year. The majority of these connections (1,338 or 61%) were reciprocated connections, meaning both fellows reported the same type of connection. Our best estimate of unduplicated connections is 1,523.⁶

Table 11. Full Fellowships Connectivity, Compared to Year Prior

2019–20 2018–19	Cohort One	Cohort Two	Cohort Three	Cohort Four	Cohort Five	Cohort Six	Cohort Seven	Cohort Eight	Total Network
<i>Total Connections</i>	420 580	246 377	295 517	184 384	323 540	271 409	246 435	207 251	2,192 3,493
<i>% Change</i>	-28	-35	-38	-52	-40	-34	-43	-18	-37
<i>% High Quality</i>	48 42	55 44	53 35	49 23	47 41	48 51	53 42	39 39	50 40
<i>% Virtual</i>	65 43%	61 46	63 55	65 47	68 38	85 54	79 52	67 55	69 48
<i>% Across Cohort</i>	71 72	76 83	72 77	77 83	76 72	65 65	62 58	54 75	69 72

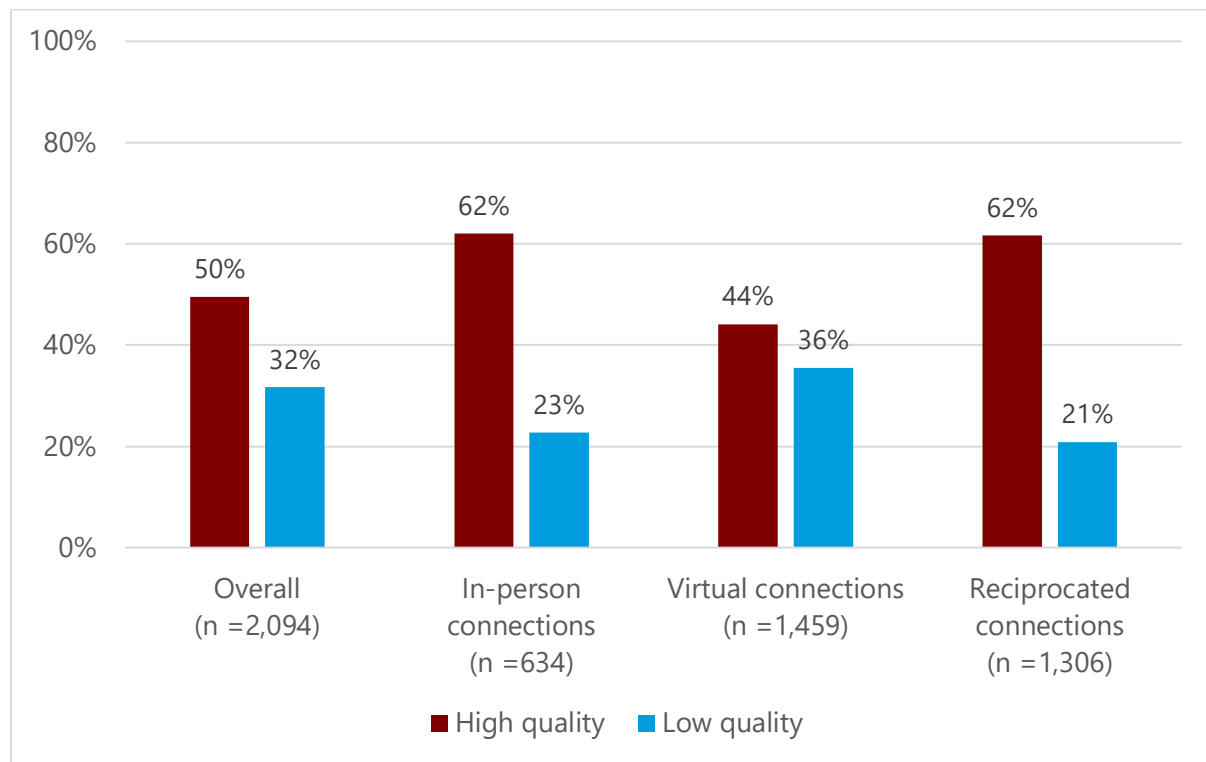
Quality of Connections

Despite the decline in connectivity across the network this year, the connections that did take place across the fellowship network were of higher quality. Using a 5-point Likert scale, fellows rated the overall quality of all connections made with each individual fellow (in-person and virtual) over the course of the year. Overall, fellows rated 96% of their reported connections, and half of these (1,037 or 50%) were rated high quality. This is a 25% increase in the proportion of

⁶ As discussed in the introduction, reciprocal connections were counted twice, once for each respondent, resulting in some duplication in our count. To understand the number of unique connections, where both fellows reporting the connection only counts as one unique connection, we divide the number of reciprocated connections in half, and add that number to the non-reciprocated connections: $(1,338/2)+854= 1,523$ unique reported connections.

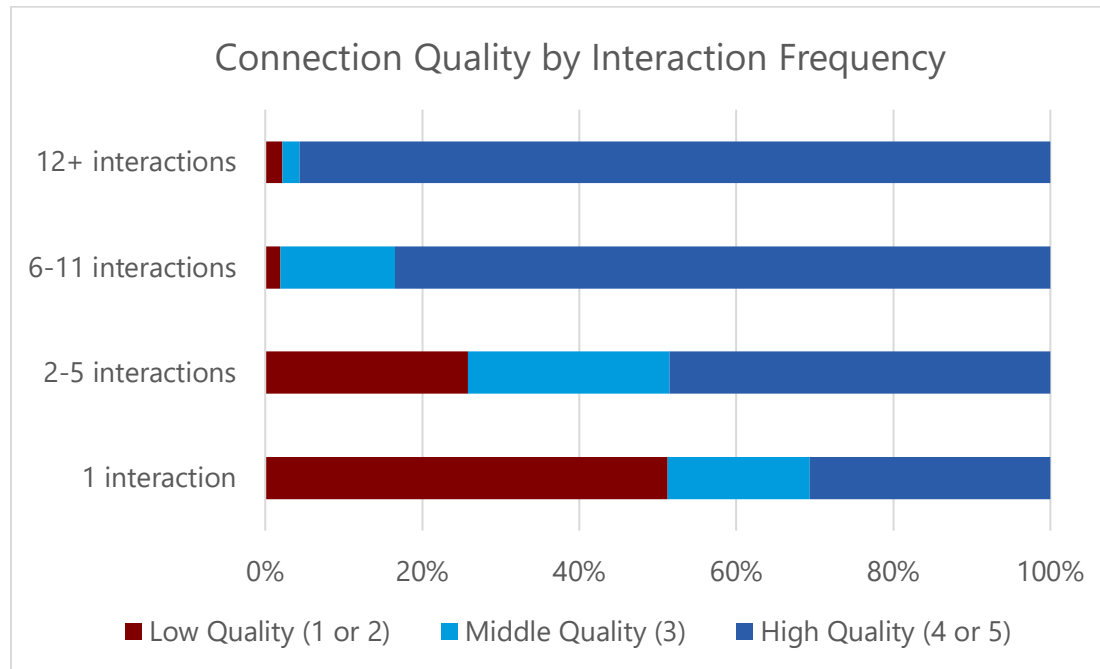
connections rated as high quality from the prior survey year. The proportion of connections reported as high-quality connections rose for each cohort's connections, with the exception of Cohort Six, which had a slight decline, and Cohort Eight, which maintained the same proportion of high quality connections as 2018–19.

Figure 10. Quality by Type of Connection



Overall, fellows rated connections that occurred multiple times throughout the year as higher quality than the connections made just once (Figure 11). Nearly all reported connections that had six or more interactions during the year classified these connections as high quality, while fellows rated just over half of all one-time connections low quality.

Figure 11. Quality of Reported Connections by Interaction Frequency



Within vs. Cross-Cohort Analysis

The Fellowships network continued to operate as one full network rather than each cohort functioning as its own distinct and smaller network. Once again, the large majority of all reported connections occurred between fellows from two different cohorts. This year, 69% of all reported connections traveled cohort boundaries, compared to 72% last year. Fellowships strategies—such as the Annual Meeting nested within a professional conference (2019 Prevent Child Abuse America National Conference), peer mentors across cohorts, and Research to Action (R2A) Grants—coupled with established relationships likely explain why the network is now consistently displayed as one cohesive and interconnected network.

While the majority of connections reported by fellows in each cohort involved fellows outside their cohort, this proportion varies across the cohorts. Across the eight cohorts, the majority of all connections were across-cohort connections, ranging from 54% (Cohort Eight) to 77% (Cohort Four).⁷ We are not surprised to see a slight decline in the proportion of across-cohort connections for several cohorts given that opportunities for across-cohort engagement, such as the Mid-Year Meeting and gatherings at conferences, were impacted by the pandemic. We also see that Cohort Eight's increased within-cohort connectivity, as reported previously, conversely impacts the proportion of connections made outside of their cohort given the overall slight decline in the cohort's reported connections.

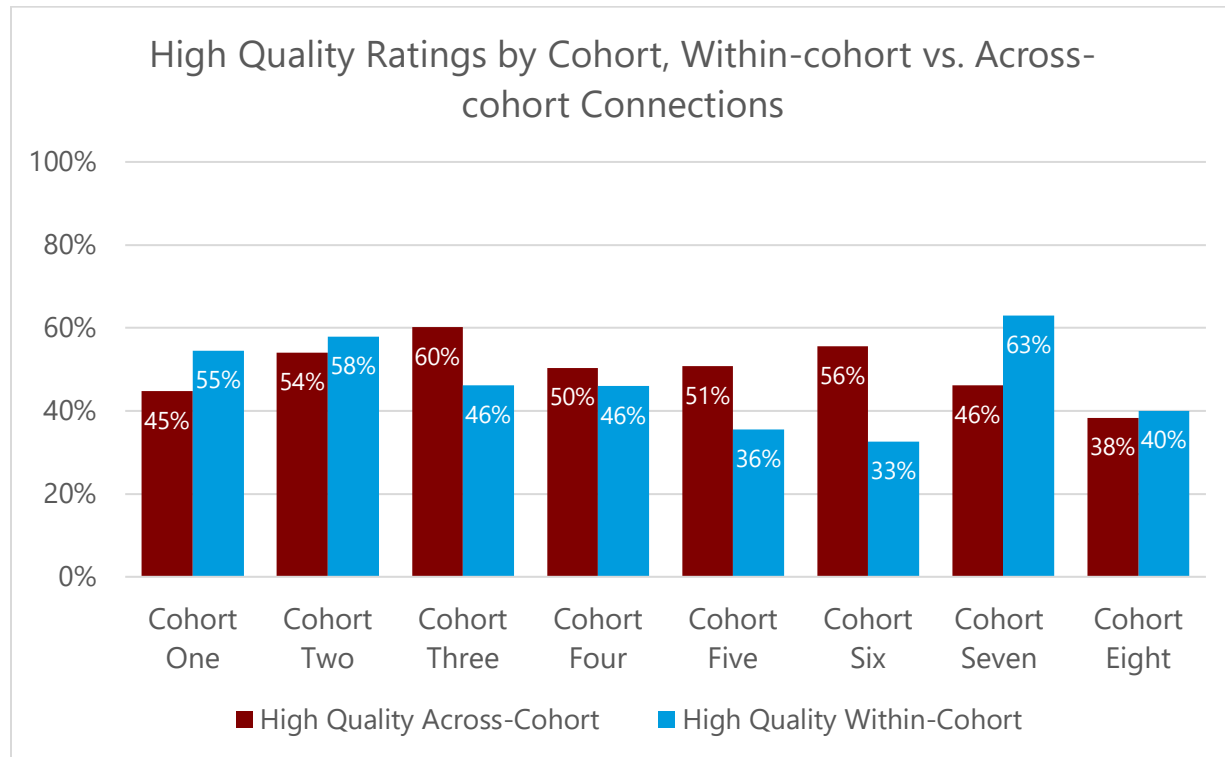
⁷ When considering cohort-specific analysis of these reports, it is important to remember that the numbers only include the fellow reporting the interaction. For example, if a Cohort Four fellow reported a connection with a Cohort One fellow but that Cohort One fellow did not report the same interaction, then that connection would not be counted in the Cohort One numbers. It would, however, be included as a cross-cohort interaction in the Cohort Four calculations.

Table 12. Full Fellowship Connections

2019-20 2018-19	Cohort One	Cohort Two	Cohort Three	Cohort Four	Cohort Five	Cohort Six	Cohort Seven	Cohort Eight	Full Fellowships Network
Total reported connections	420 580	246 377	295 517	184 384	323 540	271 409	246 435	207 251	2,192 3,493
% within- cohort	29 28	24 18	28 23	23 17	25 28	35 35	38 42	46 25	31 28
% across- cohort	71 72	76 83	72 77	77 83	76 72	65 65	62 58	54 75	69 72

When we compare how fellows rate their connections within their cohort compared to the network as a whole, we see discrepancies across the eight cohorts. Half of the eight cohorts rated connections with their cohort peers as higher quality than their connections with fellows outside their cohort (see Figure 12), For some cohorts these ratings are much closer than for others, suggesting that variability in quality in these ratings is not solely a function of whether or not the two fellows were in the same or in different cohorts. Quality, as noted earlier, is influenced by such things as the number of times fellows have interacted. Other factors may include the nature of the interaction (for example, connections on developing a specific product may be more meaningful than having a causal conversation about a specific issue) and the extent to which the relationship builds on a broad range of shared interests

Figure 12. Cohort Quality Ratings



Academic Discipline

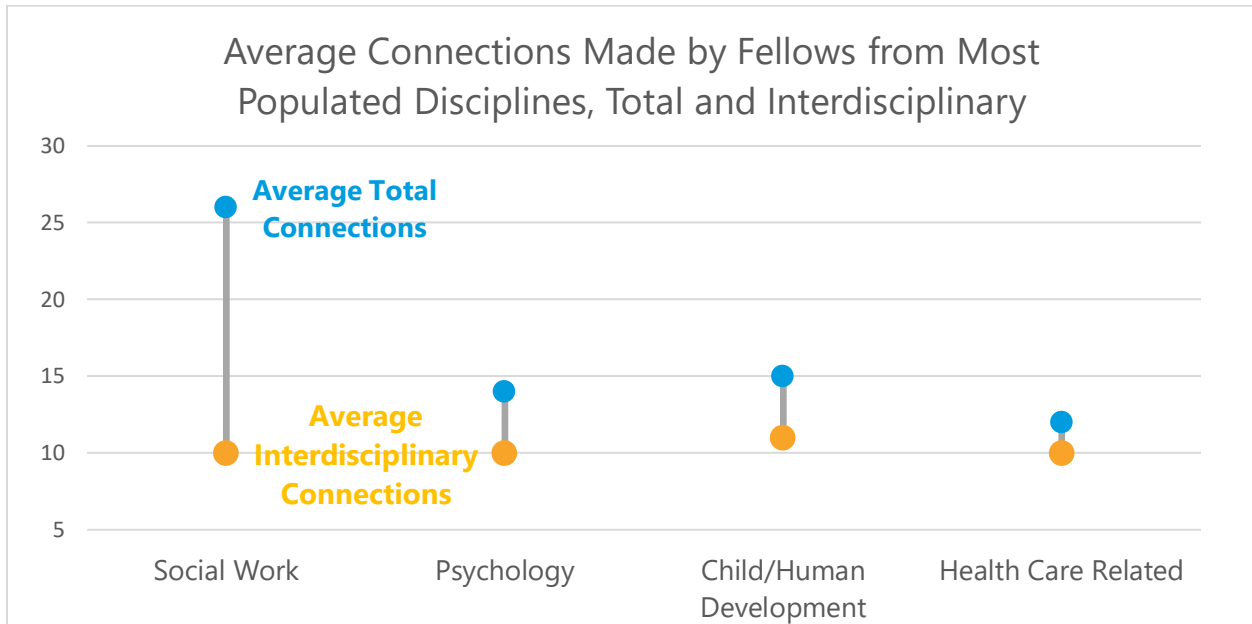
Social work is the most common discipline in the fellowships; 36% of the fellows work in the social work discipline (Table 12). Social work fellows are more connected than other disciplines in the network, as shown by the discipline density number, with nearly one-third (32%) of all possible connections between the 43 social work fellows occurring during the survey year. Among those with 10 or more fellows in the discipline, child/human development fellows are nearly as connected as the social work fellows (27% of all possible connections between these fellows occurred). Within more broad disciplines, psychology and health care-related, we asked fellows to further select their subspecialty from a list. As anticipated, we see some connection variability in these subspecialties, with clinical psychology fellows and medical/nursing fellows more connected than other subspecialties. It is important to remember that in disciplines with very small numbers, such as education or medical/nursing, the high density simply means that two fellows in these disciplines connected with each other.

Table 13. Academic Discipline Distribution and Connection

Discipline	Discipline Density	Fellows (N)	Fellows (%)
Social Work	0.32	43	36
Psychology	0.14	34	28
Clinical	0.18	21	
Developmental	0.10	5	
School	0.00	3	
Other	0.00	2	
Child/Human Development	0.27	14	12
Health Care-related	0.16	10	8
Public Health	0.10	5	
Epidemiology	0.00	2	
Medical/Nursing	0.67	3	
Public Policy/Social Policy	0.17	9	8
Sociology	0.07	6	5
Education	1.00	2	2
Criminal Justice	0.00	2	2

Throughout the network, 61% of all connections crossed disciplinary boundaries. Social work students typically bring a multidisciplinary approach to their research, teaching, and other work. Accordingly, we find social work fellows more often engage with each other than with fellows outside of social work. However, we also see that nearly half of the connections made by social work fellows cross disciplinary boundaries. Figure 13 shows that, on average, a social work fellow reported 26 connections, with an average of 10 occurring with fellows outside of social work. The average number of interdisciplinary connections reported by the fellows from the four most populated disciplines (health care, child/human development, psychology, and social work) mirrored each other. Figure 13 also shows social work fellows reported far more total connections on average than fellows from other disciplines reported.

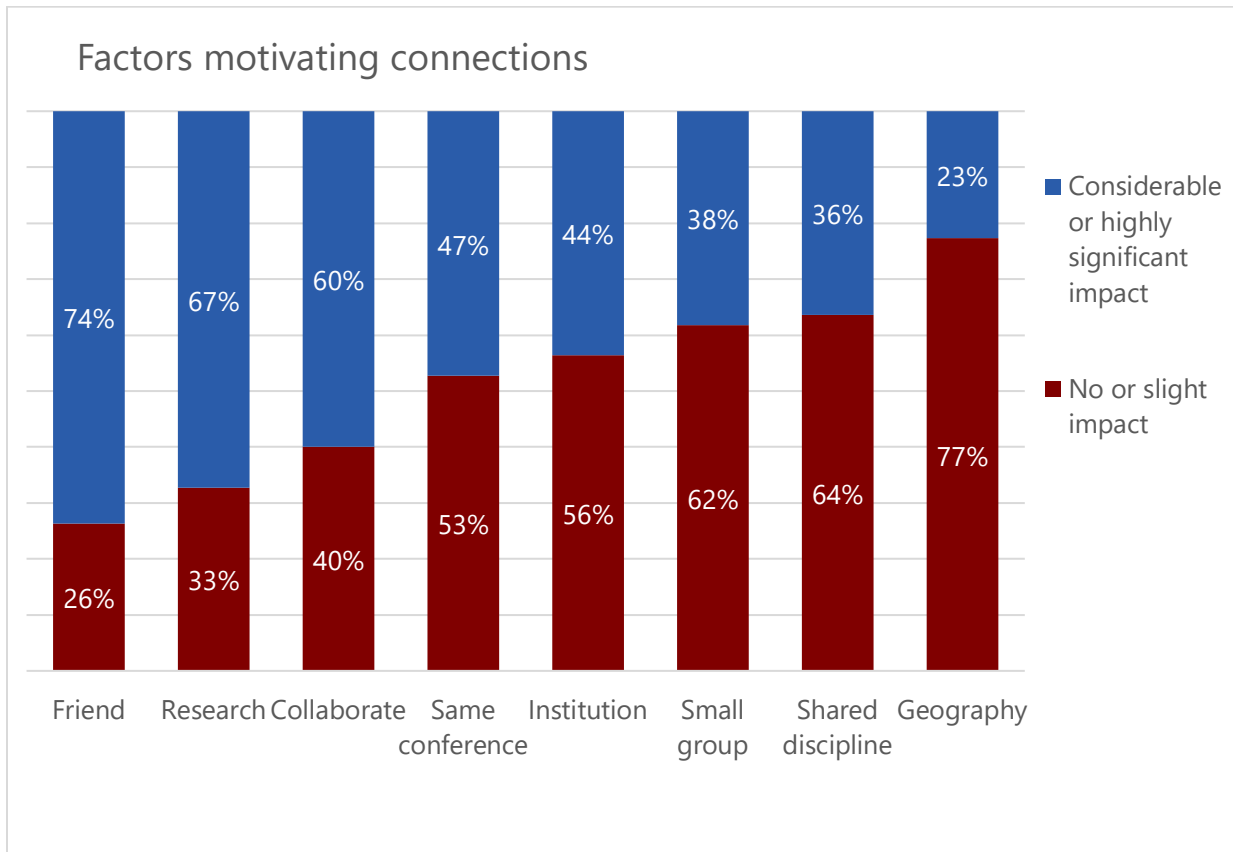
Figure 13. Average Connections by Fellows from the Four Most Populated Disciplines, Total and Interdisciplinary Connections



Motivating Connections

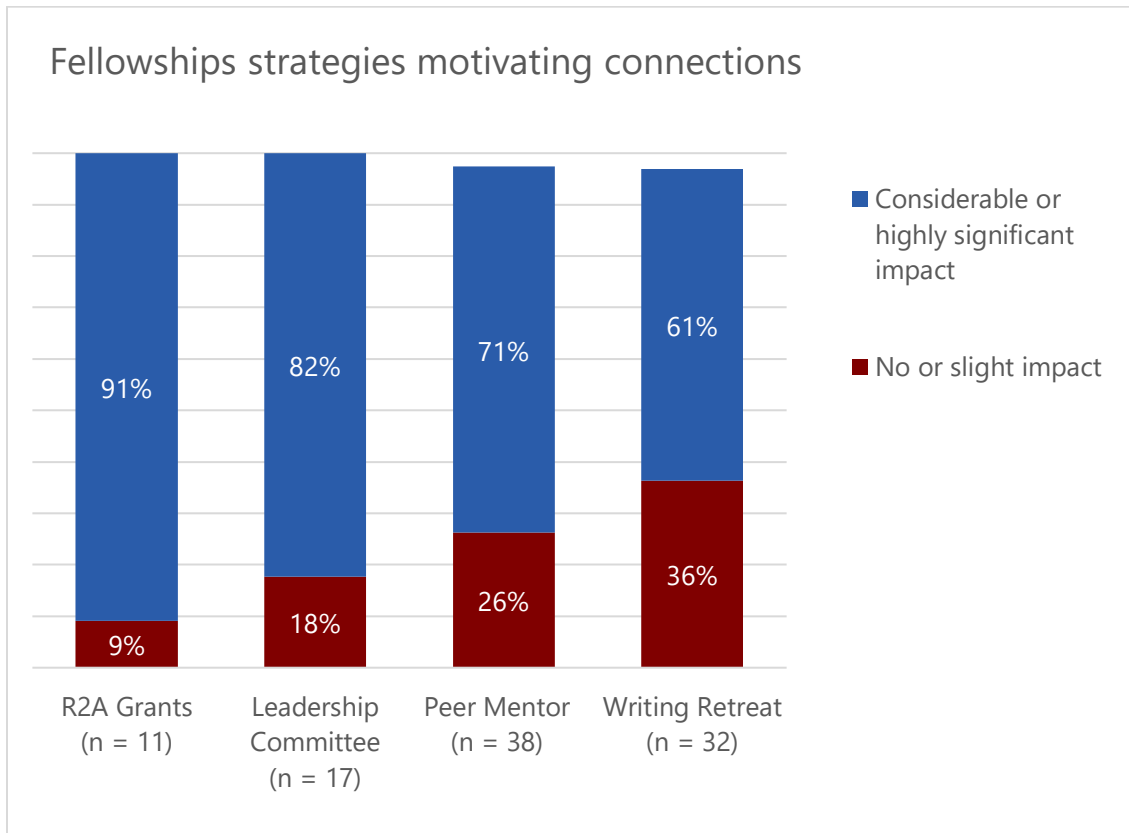
Fellows were asked to rate eight different factors and how impactful they were in driving their connections with other fellows (see Figure 14). Fellows responded to each item on a scale of 0 (no impact) to 3 (highly significant impact). We looked at last year’s responses and found no clear differences in factors motivating connections. In 2019–20, fellows noted the importance of developing friendships in determining who they engaged with during the year. Three of four fellows cited this factor as having considerable or highly significant impact on their actions to connect with their peers. Fellows again reported that having a shared research interest with another fellow and having an active collaboration were important factors when connecting with their colleagues. In a year when many conferences were cancelled, attending the same conference was the only factor that declined in importance as compared to last year.

Figure 14. Factors Motivating Connections between Fellows



There were certain fellowships strategies we expected to have a large impact on connections for those who participated, so we measured their impact separately. For those fellows reporting participation in these strategies (Leadership Committee, Research to Action (R2A) Grants, peer mentor program, and writing retreats), the survey asked about their impact on connections using the same four-point scale as the previous factors (see Figure 15). Nearly all the strategies had some impact on motivating connections for those who participated, with the most impactful being participation in an R2A Grant team. Fellows on the Leadership Committee again rated their participation as having a measurable impact on their connections. As the new Child Well-Being Research Network develops plans for its first year, it should take into account that creating leadership opportunities seems to be highly motivating for making connections and developing relationships.

Figure 15. Strategies Motivating Connections



COVID-19 Impact on Connections

Appreciating the unique impact COVID-19 had on the type, frequency, and quality of connections between fellows during this survey year, we asked questions around how the pandemic altered interactions (see Figures 16–18). The primary impact of COVID was the limits it placed on face-to-face contact, particularly if fellows did not live in the same city or work in the same institutions. We expected overall connections to be impacted. However, since in-person connections did not occur once the pandemic began, we expect COVID to only impact the quality of virtual connections, not in person. As such, we focus the quality discussion on the impact COVID had on the quality of virtual connections. The majority of fellows acknowledged that the COVID-19 pandemic resulted in fewer connections, less frequent connections, and lower quality connections.

Figure 16. COVID-19 Impact on Connections

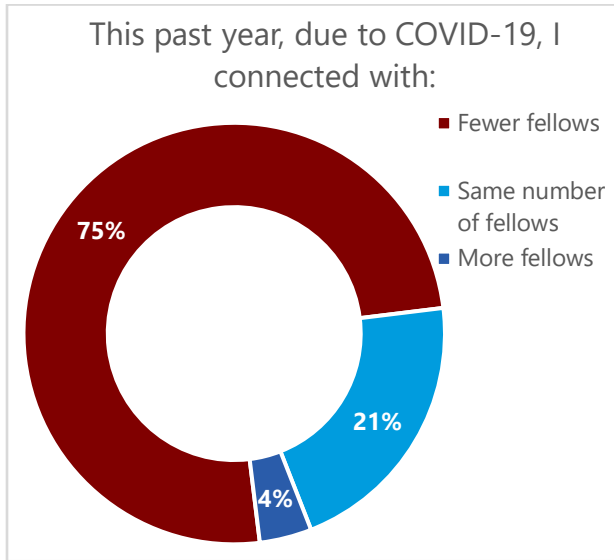


Figure 17. COVID-19 Impact on Connection Frequency

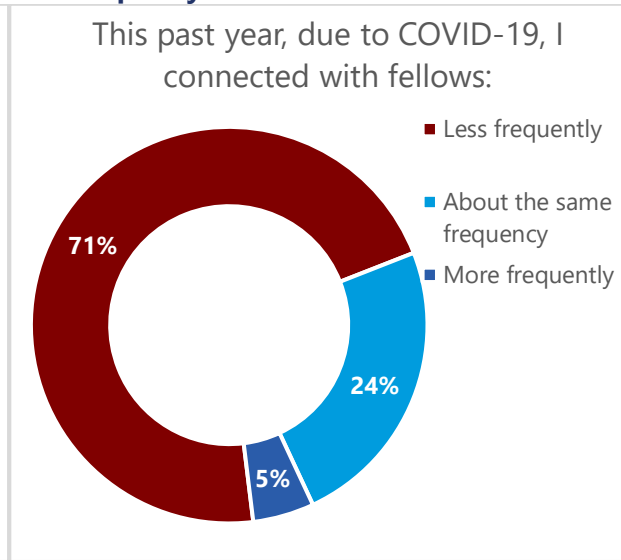
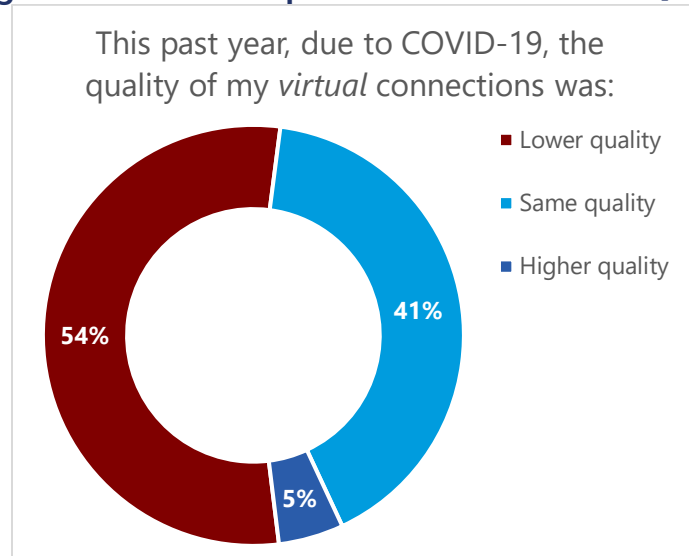


Figure 18. COVID-19 Impact on Virtual Connection Quality



Multivariate Analysis

We conducted hierarchical multiple regression analysis to identify the most salient factors in explaining variation in the number of connections fellows reported with other fellows. We found that more connected fellows in prior surveys are also more connected in the 2019–20 survey. Our independent variables included:

- Length in fellowships: We calculated the number of years each fellow had been in the fellowships; values ranged from one year for Cohort Eight to eight years for Cohort One.
- Discipline other than social work: Social Work was a score of 0 and all other disciplines were given a score of 1.

- Average connectivity: We calculated average connectivity from the survey years prior to this survey. We did this by finding a percentage of the network each fellow connected to each year, and averaging their connection percentages across the years they were active in the fellowship.

Regression results are presented in Table 13.

Table 14. Doris Duke Fellowships Covariates Predicting Total Connections in Hierarchical Regression Analysis

		ΔR^2	Final model β
Total Connections ($N = 110$)			
Step 1	Average Connectivity	.659***	.779***
Step 2	Length in Fellowships	.029**	.132**
Step 3	Discipline: Social Work	.011*	.118*
		Model $R^2 = .692^*$	

*** $p < .001$, ** $p < .01$, * $p < .05$

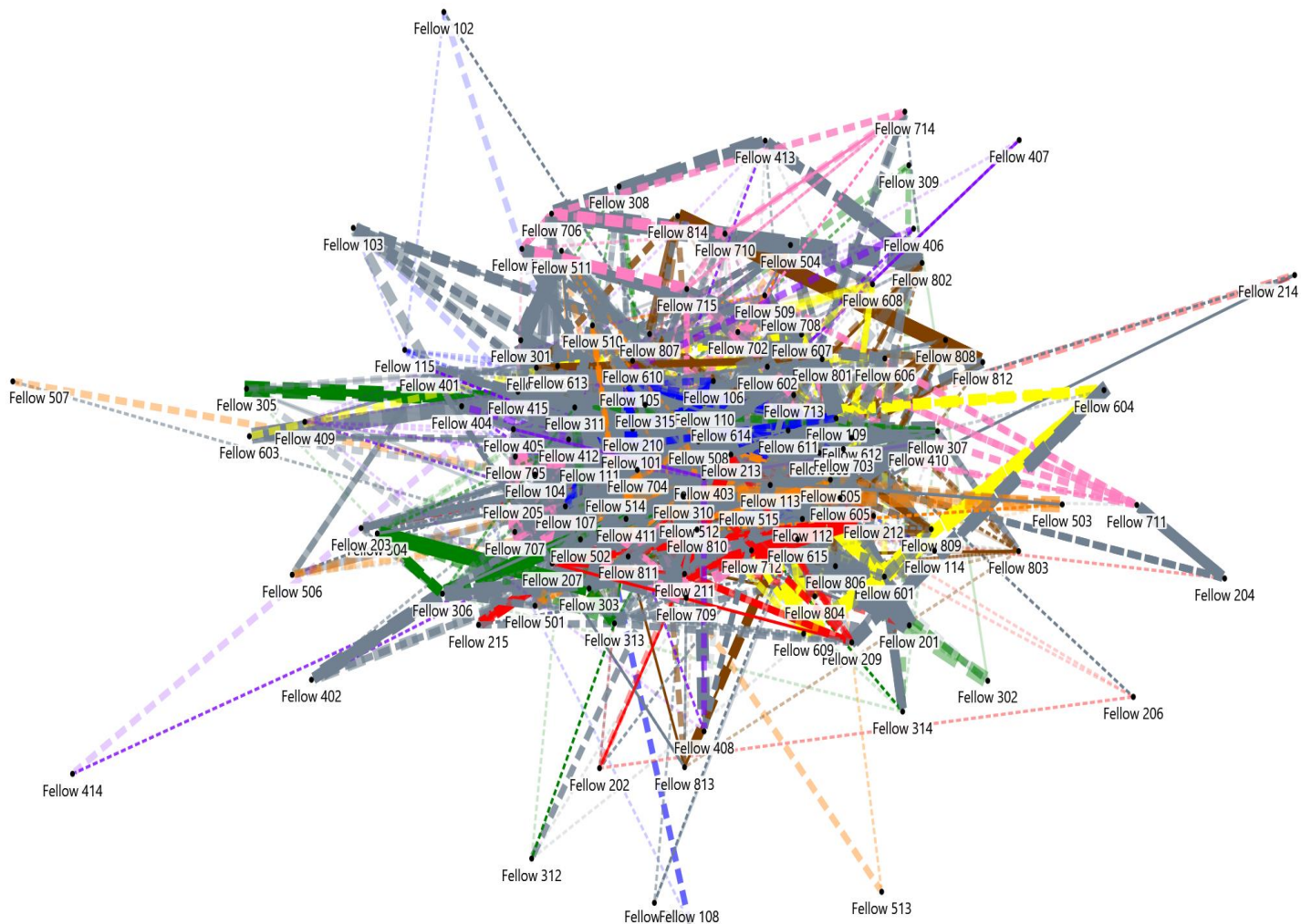
Average connectivity (between 2016 and 2019) explained 66% of the variance in number of connections in the most recent survey. Not surprisingly, a fellow’s average number of connections in prior surveys strongly predicted the number of connections reported in the current survey. Adding the length of time a fellow had been enrolled in the fellowships and whether they were in social work increased the predictive strength of the model, but only slightly (3% and 1% respectively).

This analysis tells us that the fellows that were most engaged were consistently engaged the last several years. The fellows who were on average most connected to the network in the past reported a larger number of total network connections this year. Essentially, established, authentic relationships breed future connections. Even if an individual is in the network a long time, simple duration in the network has only modest impacts on engagement levels. Buying into the network and getting engaged early on are better predictors of a higher likelihood of remaining engaged in future years.

Full Network Graphs

Figures 19 and 20 display the graphs of the full fellowships network. Figure 19 shows all 2,192 connections with colors designated for each cohort, and each fellow’s node as well as connections to their cohort peers are highlighted in their cohort’s color. Cross-cohort connections are displayed by a grey line. Figure 20 shows the network’s cross-cohort connections, thus all edges are shown in grey. The width, style, and opacity of each line still represents the frequency, type, and quality of the connection, respectively. Table 14 lists each fellow in the network organized by their betweenness centrality score (how critical a fellow is to keeping other fellows engaged in the network), along with their degree (number of fellows they connected with in the network), how that number changed from the prior year, and their discipline.

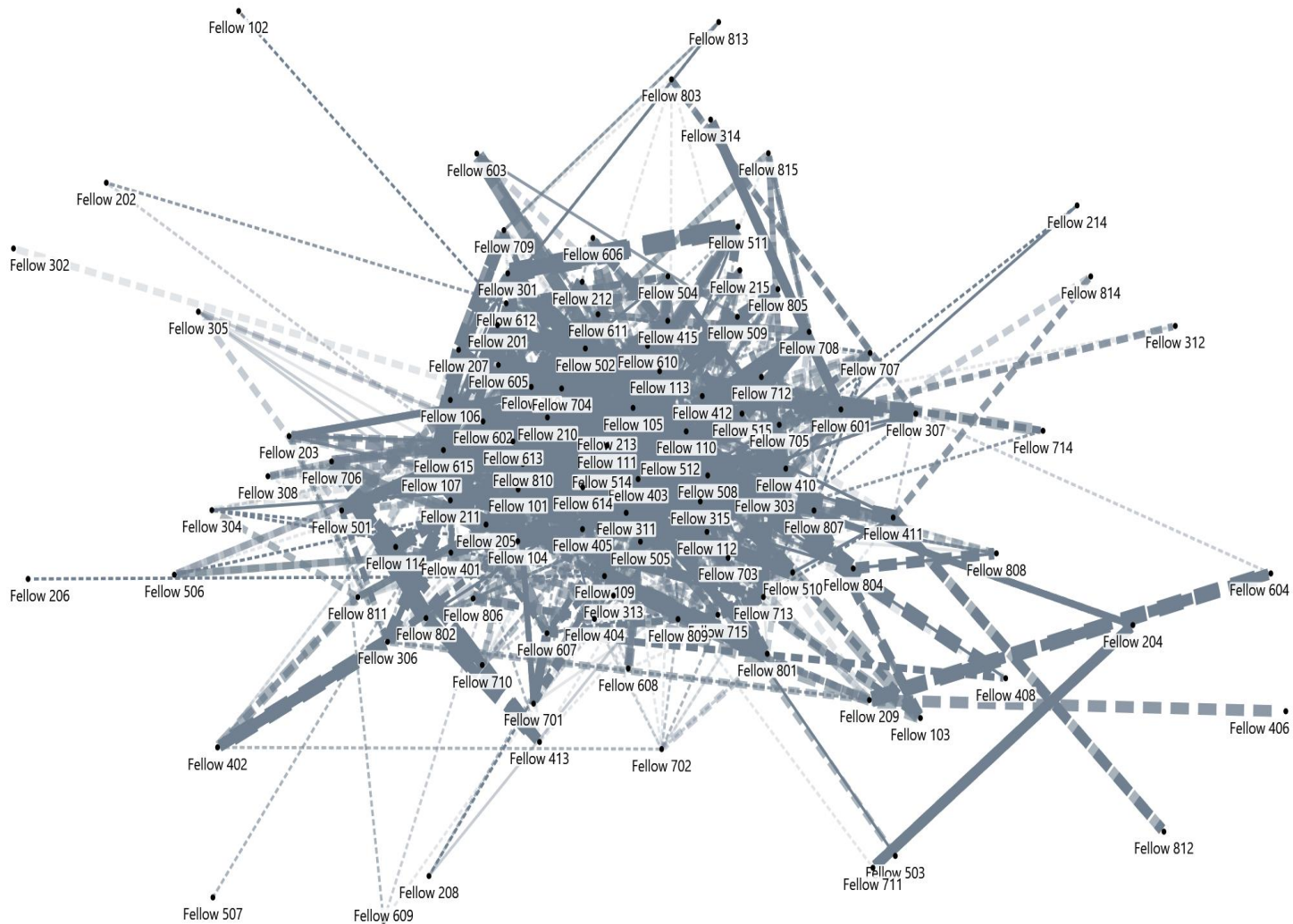
Figure 19. Full Fellowships Network: All Interactions



Notes:

- Dashed lines represent virtual interactions; solid lines indicate in-person interactions.
- The width of the line shows the total number of in-person and virtual interactions between two fellows. The broader the line, the greater the number of interactions.
- Blue lines indicate Cohort One's within-cohort interactions.
- Red lines indicate Cohort Two's within-cohort interactions.
- Green lines indicate Cohort Three's within-cohort interactions.
- Purple lines indicate Cohort Four's within-cohort interactions.
- Orange lines indicate Cohort Five's within-cohort interactions.
- Yellow lines indicate Cohort Six's within-cohort interactions.
- Pink lines indicate Cohort Seven's within-cohort interactions.
- Brown lines indicate Cohort Eight's within-cohort interactions.
- Grey lines show cross-cohort interactions.

Figure 20. Full Fellowships Network: Across-cohort Interactions



Notes:

- Dashed lines represent virtual interactions; solid lines indicate in-person interactions.
- The width of the line shows the total number of in-person and virtual interactions between two fellows. The broader the line, the greater the number of interactions.
- Blue discs indicate a Cohort One fellow.
- Red discs indicate a Cohort Two fellow.
- Green discs indicate a Cohort Three fellow.
- Purple discs indicate a Cohort Four fellow.
- Orange discs indicate a Cohort Five fellow.
- Black discs indicate a Cohort Six fellow.
- Pink discs indicate a Cohort Seven fellow.
- Brown discs indicate a Cohort Eight fellow.
- Grey lines show cross-cohort interactions.

Table 15. Full Fellowships Network: Descriptive Statistics

Fellow ID	Betweenness Centrality	2020 Degree	Difference	2020 Discipline
Fellow 111	610.4656	69	-12	Social Work
Fellow 213	501.6617	57	-32	Social Work
Fellow 512	390.1069	58	10	Developmental Psychology
Fellow 315	380.8994	55	-25	Social Work
Fellow 311	343.3797	50	-69	Social Work
Fellow 514	312.9795	47	-34	Clinical Psychology
Fellow 403	250.2818	45	-42	Social Work
Fellow 411	242.5524	28	3	Education
Fellow 101	240.4106	47	2	Social Work
Fellow 810	230.9919	41	-6	Other Psychology
Fellow 110	176.7644	49	-28	Social Work
Fellow 105	159.8847	43	-16	Social Work
Fellow 508	155.6451	30	-19	Social Work
Fellow 210	143.7815	42	-40	Social Work
Fellow 415	130.7854	26	4	Social Work
Fellow 614	124.2098	36	-10	Health Care-related, Public Health
Fellow 107	109.4256	32	-2	Social Work
Fellow 704	105.612	38	-3	Social Work
Fellow 405	95.2122	21	-9	Social Work
Fellow 515	90.16317	25	-25	Social Work
Fellow 505	89.16529	27	-32	Child/Human Development
Fellow 807	86.40093	23	-1	Clinical Psychology
Fellow 613	85.90071	27	-3	Social Work
Fellow 109	84.0107	23	-21	Clinical Psychology
Fellow 412	81.84398	33	-47	Child/Human Development
Fellow 811	78.6213	21	1	Social Work
Fellow 805	78.56879	25	0	Child/Human Development
Fellow 211	71.66236	25	-5	Social Work
Fellow 310	66.33015	34	-10	Social Work
Fellow 601	65.43528	23	-18	Child/Human Development
Fellow 113	63.50957	27	-5	Public Policy/Social Policy

Fellow ID	Betweenness Centrality	2020 Degree	Difference	2020 Discipline
Fellow 713	60.47493	23	-7	Child/Human Development
Fellow 112	59.45067	23	2	Social Work
Fellow 703	56.0344	23	-14	Child/Human Development
Fellow 207	53.52846	23	-2	Social Work
Fellow 615	53.42592	28	2	Public Policy/Social Policy
Fellow 205	52.70783	16	1	Developmental Psychology
Fellow 313	51.77584	21	1	Public Policy/Social Policy
Fellow 605	51.73834	23	-13	Public Policy/Social Policy
Fellow 104	49.72674	29	6	Criminal Justice
Fellow 715	44.48952	21	-20	Health Care-related, Public Health
Fellow 612	43.17467	27	-6	Sociology
Fellow 306	42.12458	18	-5	Health Care-related, Medical
Fellow 611	41.82424	23	-5	Clinical Psychology
Fellow 702	41.33993	18	-17	Clinical Psychology
Fellow 610	40.69444	25	-3	Clinical Psychology
Fellow 307	36.72428	14	-11	Child/Human Development
Fellow 705	36.57281	25	0	Social Work
Fellow 303	36.45456	22	-6	Education
Fellow 712	35.95376	27	-11	Child/Human Development
Fellow 502	33.47071	27	-1	Social Work
Fellow 801	33.19702	17	-11	Clinical Psychology
Fellow 708	33.15883	16	-21	Clinical Psychology
Fellow 809	33.06239	17	-10	Clinical Psychology
Fellow 806	29.93605	17	5	Sociology
Fellow 804	29.88778	15	-6	Social Work
Fellow 209	29.87709	12	-2	Clinical Psychology
Fellow 802	29.50172	12	-12	Health Care-related, Epidemiology
Fellow 710	28.38431	16	-14	Developmental Psychology

Fellow ID	Betweenness Centrality	2020 Degree	Difference	2020 Discipline
Fellow 410	28.30899	18	-8	Clinical Psychology
Fellow 709	27.03848	16	-13	Public Policy/Social Policy
Fellow 106	26.85536	26	-3	Social Work
Fellow 607	23.50425	16	-11	Sociology
Fellow 707	23.37228	21	-13	Clinical Psychology
Fellow 115	22.40278	13	9	Clinical Psychology
Fellow 602	22.15391	21	-5	Social Work
Fellow 401	21.96245	15	0	Social Work
Fellow 501	21.01281	16	6	Health Care-related, Epidemiology
Fellow 509	17.39058	12	-16	Other Psychology
Fellow 803	15.86455	13	-7	Developmental Psychology
Fellow 510	13.68249	19	-42	Health Care-related, Public Health
Fellow 706	11.58468	9	-20	Child/Human Development
Fellow 701	11.21417	12	-18	Public Policy/Social Policy
Fellow 606	10.85223	15	-3	Child/Human Development
Fellow 413	10.23029	8	-3	Developmental Psychology
Fellow 404	9.907102	15	-10	Social Work
Fellow 301	9.365877	16	0	Social Work
Fellow 609	9.119315	11	-15	Clinical Psychology
Fellow 711	9.105147	6	-21	Public Policy/Social Policy
Fellow 608	7.789716	11	-19	Child/Human Development
Fellow 815	7.138873	10	-11	Clinical Psychology
Fellow 201	6.087034	10	2	Social Work
Fellow 304	4.71754	11	0	Health Care-related, Medical
Fellow 402	4.379699	5	-7	Health Care-related, Public Health
Fellow 814	4.26655	8	-10	Child/Human Development
Fellow 808	3.944061	8	-7	Social Work

Fellow ID	Betweenness Centrality	2020 Degree	Difference	2020 Discipline
Fellow 212	3.939791	12	-4	Social Work
Fellow 504	3.893207	10	-11	Social Work
Fellow 812	3.818697	8	-13	School Psychology
Fellow 203	3.404179	8	-1	Health Care-related, Medical
Fellow 204	3.104062	3	-3	Health Care-related, Public Health
Fellow 714	3.080227	6	-28	Public Policy/Social Policy
Fellow 409	3.023727	8	1	Sociology
Fellow 114	2.654313	7	1	Social Work
Fellow 314	2.645118	6	-2	Child/Human Development
Fellow 604	2.636992	5	-9	Clinical Psychology
Fellow 103	2.204907	6	0	Clinical Psychology
Fellow 308	2.044692	8	-7	Social Work
Fellow 302	2.011651	4	-13	Clinical Psychology
Fellow 215	1.849986	11	1	Social Work
Fellow 511	1.567928	12	-12	Social Work
Fellow 506	0.794969	6	-25	School Psychology
Fellow 503	0.417794	6	-16	Clinical Psychology
Fellow 206	0.348173	4	-1	School Psychology
Fellow 309	0.333333	4	-1	Clinical Psychology
Fellow 102	0.243191	3	1	Social Work
Fellow 414	0	2	-4	Criminal Justice
Fellow 513	0	2	-8	Clinical Psychology
Fellow 214	0	3	-1	Sociology
Fellow 108	0	2	-4	Social Work

DISCUSSION

The Doris Duke Fellowships network continues to connect child well-being professionals beyond their 2-year program in the fellowships. While the COVID-19 pandemic impacted the number of connections fellows made, it did not destroy the network (see Table 15). This survey year showed us the network is sustainable in a virtual world, in large part due to the investment fellows made early on to develop professional and personal connections. Because the fellowships network was already largely virtual with a few in-person meetings a year, the shift to all virtual did not have a large impact. As one fellow noted in their survey response, “The fellowship provided a trusted and needed support system that was already functioning virtually (for the most part).”

Additionally, while connections were down in 2019–20, connection quality was sustained or improved. Each year, existing relationships likely grow stronger and fellows find ways to engage with and learn from each other. This is significant because the quality of virtual connections are rated much lower than in-person ones (see Figure 10), and yet when a third of the survey year was all virtual, quality still rose 25%.

Once again, this year’s analysis and the trends we observe from years past show us that cohorts differ. Cohort connectivity is not linear; cohorts experience high and low years of connectivity. While we cannot tell from social network analysis why some cohorts tended to be more cohesive from the onset than others, we do know the critical importance the key cluster of fellows within each cohort can play to keep the network interconnected. At the same time, when looking at the full network, we see the network has grown from eight distinct cohorts to one cohesive network, as fellows continue to cross cohort and discipline boundaries to make connections.

Table 16. Full Fellowships Connectivity Trends

	2019–20	2018–19	2017–18	2016–17	2015–16
Total no. of connections (n)	2,192	3,493	2,498	1,848	1,133
Average network degree, as % of whole network	16	24	22	22	22
Network Density (%)	16	24	22	23	23
Connections rated high quality (%)	50	40	45	45	48

We know there are some limitations to our study. We ask fellows to recall connections made over the past year and self-report a range of interaction frequency. There is inherent recall bias

in this data collection method. Older connections, especially those made only once, may tend to be forgotten or underrated in their quality compared to more recent connections. Additionally, because each fellow in a pair can report a connection, some connections are double counted.

As our analysis showed, connections do breed connections—once fellows are active in the network, they tend to remain active. These findings will have significant implications as the fellowships transition to the Child Well-Being Research Network. The Network provides opportunities for new individuals to join, and already offers opportunities for engagement, leadership among the current members, and has expanded the network's diversity in race, ethnicity, levels of experience, and academic background. Given the findings from this and recent network surveys, we highlight three important recommendations for the Network:

- **Engage new members early.** We see how early engagement can predict future connectivity. The Network should intentionally provide opportunities for new members to get engaged with other members.
- **Provide targeted strategies for smaller groups of Network members.** Our findings suggest that strategies that involve smaller groups of fellows (such as R2A Grants, writing retreats, and other activities) provide considerable impact in influencing connections. Providing opportunities for smaller groups of Network members to gather and connect over a common shared interest may foster connections.
- **Provide in-person engagements when possible, but virtual connections do work.** While nearly all fellows indicated they prefer to connect in person, and in-person contact will be important for engaging the newest members, it is possible to provide meaningful opportunities to engage virtually. One existing example is the writing retreats that fellows have instituted for years and convene virtually a few times a year. This coming year will provide opportunities for more in-person contact as well as chances for Network members to connect virtually.

Like everything else, the fellowships network faced challenges to maintain connections and relationships when the pandemic hit. However, the fellowships network survived and continued to make meaningful, high-quality connections. As the Child Well-Being Research Network launches, we believe the lessons learned from our social network analyses can not only inform future engagement strategies but they indicate the Network can thrive as new members join.

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