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The Role of Ecumenism and Education in Transnational Women's Organizations: A Network Analysis of Colonial Missionary Agencies

Abstract:
Higher education and voluntary associations expanded dramatically over the 20th century. While many have noted the impact of colonial Protestant missionaries on these transformations, none have examined the unique influence of Protestant women and women's organizations. Drawing on a unique historical data set of Protestant missionary societies at the height of their global reach and ecumenical collaboration (1925), I construct an affiliation matrix of 49 missionary agencies and the 34 global colleges they cosponsor. Employing novel two-mode social network measures—dual-projected flow betweenness and bi-cliques, I explore the nature of ties between mission agencies and mission colleges, considering the role that women's colleges and organizations played in shaping transnational collaboration. I find that women's organizations exhibited greater collaboration among themselves, compared to the network as a whole, and women's colleges played a critical role in fostering transnational collaboration.

The 20th century has seen the formation and expansion of a world society in which transnational organizations and mass formal education reaches into nearly every nook and cranny of society, from Cairo to Comoros. This global cultural phenomenon is not limited to any one organization or national culture; rather it is a diffuse macro-level transformation of the past century linked to educational expansion, cultural rationalization, liberal individualism, and the development of voluntary associations (Meyer and Bromley 2013; Schofer and Longhofer 2011). Women's transnational organizations, i.e. women's international non-governmental organizations (WINGOS), have played a critical role in advancing this transformation through expanding educational, social, and political opportunities for women (Berkovitch and Bradley 1999; Pandian 2018; Paxton, Hughes, and Green 2006). Education transforms society and individuals, creating new roles and capacities for rationalized universal knowledge and action (Meyer 1977), and this capacity for rationalized universal knowledge and action lies at the heart of (and equips hands for) voluntary associations (Baker 2014). As such, the expansion of women's organizations and education for women go hand in hand in the expansion of world society.

That this relationship between voluntary associations and education is also tied to religion has not gone overlooked. The early stages of mass educational expansion in the U.S. in the 19th century were led primarily by priests, pastors, and patriotic parishioners who coupled religious aims with education and nation-building (Baker 1999; Meyer et al. 1979; Tyack 1966). The expansion of women's educational opportunities were part and parcel of this movement (Sweet 1985). Others have chronicled wide-ranging efforts of 19th century Protestant missionaries to expand mass education and catalyze civil society throughout the non-Western world (Sunquist 2001; Woodberry 2007, 2012). What receives less attention is that this Protestant missionary

movement was mostly female. By 1938, 63% of all Western Protestant missionaries were female (16,279 in total), and over half of these were unmarried women teachers and doctors. By 1915 over forty denominational women's mission societies with three million active members existed in America alone, eclipsing the membership of even the Women's Christian Temperance Union (Hill 1985:3–8), ddemonstrating organizational capacity on par with many of the more well-known women's social movement organizations of the time (Beaver 1980; Robert 1996). When considering transformations in women's development and education, the relevance of transnational religious organizations should not go unexamined.

In this study, I analyze the network of early 20th century Protestant mission agencies and the colleges, universities, and medical schools they supported throughout Asia, Africa, and Latin America. I consider specifically the nature of collaboration in the network, the key actors and sites of collaboration, and the role of woman's missionary organizations in this network. Using social network analytical methods, I describe the important actors in this network and highlight the important role women's colleges played as sites of collaboration. Specifically, along with several traditional bipartite network measures, I utilize three network measures well-suited for a two-mode network such as this—dual-projected flow betweenness to measure importance for network flow of information and resources, a two-mode transitivity measure which I term "affiliative transitivity," and a subgroup analysis using bi-cliques. I find that certain mission fields generated more collaboration than others, women's agencies added to the collaboration of the network in limited fashion, and women's colleges were highly significant for the overall network structure.

Ecumenism, Women's Mission Societies, Global Networks

Scholarship on late 19ᵗʰ and 20ᵗʰ century global Protestantism typically emphasizes two important organizational developments: ecumenism and women's movements. Ecumenism was an idea which grew out of the missionary movement as indigenous church leaders in the mission field and Western missionaries grew weary of competition and eager to realize a global, undivided Christian church (Robert 2009). Religious motivations manifested in rationalized and institutionalized ideals and policies of collaboration, comity, and consolidation of denominations and national churches (Hao 2001). Egalitarian progress was central to this ecumenical ethos, and many considered it the church's role to further it in the world through evangelism and education. However, traditional gender roles complicated efforts to evangelize and educate. On the Protestant side, women were rarely allowed to preach; only 6% of American denominations ordained women in 1890 (Chaves 1996). On the mission field, male missionaries faced significant cultural barriers to evangelizing women and incorporating them into churches. A global women's missionary movement emerged in the late 19ᵗʰ century to remedy this problem, legitimizing and supporting thousands of unmarried female missionaries to start schools and hospitals for women and children. With respect to higher education, these women started the first women's colleges in much of the world, many of which continue to operate as prestigious institutions (Robert 1996; Seton 2013; Woodberry 2007). Both education and women's mission activity featured prominently in the 1910 Edinburgh missionary conference, the most globally inclusive meeting of Protestants to date and the catalyst for the ecumenical movement (Robert 2009). This conference and movement eventually coalesced into the World Council of Churches, a transnational religious body deeply enmeshed in global civil society and the world polity.

Several features of the ecumenical and women's movements are important to note for understanding their coordination in educational work. The women's missionary movement

gained traction and expanded rapidly due to ideological and organizational distinctives. While progressive in many aspects, leaders in the movement maintained the appropriateness of gender-separate spheres of labor on the mission field. This led to separate female mission associations and vocations circumscribed to teaching, medical work, and evangelism with mostly women and children.[1] Second, these women's movements did not maintain a parallel track of mission work indefinitely. Whether for ecumenical concerns for unity or in order to absorb the significant resources and personnel of these women's agencies, nearly all of the denominational mission boards folded the women's agencies into theirs by the start of WWII (Robert 1996).

In sum, the Protestant missionary movement of the late 19th and early 20th centuries exemplified and expanded an emerging world society in which rationalized universal action through voluntary societies, supported by mass education, became ubiquitous and taken-for-granted. In this network of associations, modern principles of efficiency, rationalized coordination and collaboration, and progressive efforts for women's empowerment shaped the network and facilitated consolidation and cooperative efforts, particularly in higher education.

The Current Study

In this study, I analyze this network of Protestant missionary agencies in their collaboration for higher education. My research questions are twofold:

1. How was ecumenism structured in Protestant collaboration on higher education?
2. What role did women's agencies and women's colleges play in the structure of collaboration?

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[1] There are many examples of both Western women and indigenous Christian women preaching and leading men, particularly in China. However, this was not the dominant rhetoric or policy.

Drawing on historical data and scholarship, I explore the nature of ties between mission agencies and mission colleges, and I consider the role that these colleges—particularly the women's colleges—play in shaping patterns of collaboration. Specifically, I construct a social network of Protestant mission agencies and the mission college each supported in the early 20th century. Most of the mission agencies are headquartered in Western countries with missionaries located all throughout the non-Western world. All of the mission colleges in the study are located in Asia, Africa, or Latin America. In this network of mission agencies, shared support of a particular college is an indicator of ecumenical collaboration and a potential site for pooling resources and transmitting important information. It is important to note that this network of mission agencies represents ecumenical efforts to consolidate educational efforts. It does not represent the full range of educational efforts, but it is the most ecumenical of these efforts. As such, it is an important site to explore the structure of ecumenism at its best and to consider the role of women's agencies and colleges in this context.

Data/Analytical Plan

My data is from the 1925 World Atlas of Christian Mission (Beach and Fahs 1925), which records missionary agency, staffing, schools, and other field work statistics for all major missionary agencies in over 160 countries in 1923. This edition of the Atlas was one of the last in a series beginning in the 1890's, and it is the most comprehensive and complete. I'm using a list of missionary-sponsored higher education institutions (schools, theological colleges, colleges and universities) and the missionary agencies which sponsor or founded each institution. In most cases, more than one missionary agency sponsored an educational institution, meaning, that they supplied administrative staff, teachers, and/or funding. In this network, American and British agencies make up the majority in the network, and Presbyterian mission boards are the most

numerous. Almost half of the mission colleges are in China; 24 are in East Asia. Fourteen of the mission agencies are women's agencies or women's auxiliaries of the main denominational agency, and nine of the colleges and universities are women only.

The mission agency-mission college data is a two-mode affiliation network containing 49 mission agencies and 34 colleges and universities. In this network, agencies' mutual support of the same college constitutes ecumenical collaboration, as these colleges and universities were the product of formal union and cooperative efforts (Beach and Fahs 1925:11, 15). Following the disruption of WWI and the growth of indigenous and national churches, metropolitan bases of missionary work became less centralized (Beach and Fahs 1925). Furthermore, following the Edinburgh Missionary Conference of 1910, regional follow-up conferences further facilitated decentralized network collaboration (Hao 2001; Robert 2009). Thus, these ties between agencies through colleges in the mission field (i.e. locations in Asia, Africa, and Latin America) constitute opportunities for the flow of information about educational strategies, strategies for dealing with colonial or national governments, etc. and resources in terms of curriculum, staff, and finances.

Analysts of two-mode data often transform the network into a bipartite matrix with both modes present in the same matrix. The advantage of this method is that all of the network information can be analyzed simultaneously and with traditional network methods (Borgatti, Everett, and Johnson 2018). Some adjustments must be made when normalizing centrality scores in order to account for the fact that no within-mode ties can exist. Others analyze two-mode data by projecting each mode into two one-mode symmetric matrices and analyzing them separately. While analysis of these one-mode projections does not fully account for the entire network structure, Everett and Borgatti (2013) show that the information loss is relatively minor and can be remedied through routines to combine measures from the two one-modes matrices into one

"dual-projected" measure. Everett (2016) shows in particular how to calculate betweenness centrality using information from both one-mode projections. I follow traditional wisdom in analyzing two-mode networks with a bipartite matrix and recent developments in the dual-projection approach, comparing centrality measures from both. I analyze degree and eigenvector centrality from the bipartite graph, and I compare flow betweenness using both the bipartite and dual-projection approach.

Centrality

A mission agency or mission college's role in supporting ecumenical collaboration and resource sharing is dependent upon their centrality in the network. In assessing the role of agencies and colleges, degree provides a picture of how active or popular the agency or college is in the collaboration network. This is the only measure that does not depend on the network as a whole, so it is a useful measure to evaluate how extended an agency is in its deployment of educational resources or how diverse and robust is a college's support base. A high degree centrality for a mission agency could translate into significant leverage in the network through stakes in multiple colleges. A high degree centrality for a college would make it robust to the loss of some mission agency support, providing it security in its institutional operations and possibly influence as an example to other colleges.

Eigenvector centrality identifies the capacity of an agency or college to influence the network through information, resources, or personnel. Agencies and colleges with high eigenvector centrality demonstrate greater potential to receive or disseminate information and resources (such as educational strategy or institutional needs). One caveat with eigenvector centrality is that it could potentially inflate a node's centrality if it is connected to some of the same nodes to which its alters are connected. We also use 2-step reach centrality—the number of

nodes connected to within two steps—to check this possibility. This is particularly helpful in a two-mode network as ties between agencies or between colleges are by two steps.

Another way to measure influence, especially with respect to the flow of resources, is flow betweenness. Flow betweenness centrality measures the amount of flow that a node contributes to the network as defined by the decrease in flow with its removal. Flow is defined as the sum of all the edges of a network, and as such, it can describe both valued and binary ties. The standard flow betweenness measure of a node is the amount of flow which is reduced when that node is removed from the network. When used with a valued network, this measure accounts for the possibility that some ties have greater capacity for the flow of information or resources than others. In addition to standard measure, I employ the dual-projection approach to flow betweenness as pioneered by Bonacich (1991) and expanded by Everett (2016), as it more fully utilizes all of the network data. Given this method's relative novelty, I explain in some detail the process.

Taking the agency-college matrix as the two-mode matrix *A*, *a* is the one-mode agency-projected matrix AA^T with centrality measure *r, e* is the one-mode college-projected matrix $A^T A$ with centrality measure *c*, then the agency centrality, *ac,* and college centrality, *ec,* scores can be calculated by $ac = Ar \ and \ ec = A^T c$ (Everett 2016:3). Using the Southern Women data, Everett (2016) shows that dual-projected flow betweenness picks up on the higher betweenness of two women who attended several core events and two peripheral events whereas the standard bipartite betweenness did not rank these women as high. With respect to the mission network, this method will enable us to consider the role of agencies in facilitating information and resource flow as a function of the role of colleges and vice versa. For instance, an agency's flow betweenness may be much lower in the dual-projected measure because the colleges it connects

the network to are not very central. As we are interested in the agencies and colleges that potentially played critical roles in ecumenical collaboration and resource pooling, it is important to consider both approaches.

Cohesion and subgroups

In order to analyze the degree to which the network manifests collaboration and sharing or pooling resources, I will analyze several cohesion measures for the whole network. As I am also interested in the effect of the women's agencies and women's colleges for network collaboration, I will analyze these measures with and without women's agencies and colleges, comparing and interpreting the differences. In this network, the density— percent of ties in a network compared to the number possible—represents the collaborative activity of the network with higher valued indicating greater collaboration. Comparing the network under different conditions provides insight on the sources of collaborative activity. I also evaluate the average distance, diameter, and fragmentation of the network as measures of collaborative capacity.

Transitivity is a measure of the "clumpiness" of a network and generally refers to the closure of triads in a network where the maximum value is 1 (Borgatti et al. 2018). However, using triad closure to calculate transitivity is not possible with a two-mode network, therefore one solution is to develop a comparable two-mode measure (Borgatti 2009). UCINET calculates the transitivity of two-mode networks as the number of quadruples with four legs divided by the number with only three legs. This method implies a revised definition of closure as a complete four-leg quadruple, e.g. Agency A–College C–Agency B–College D–Agency A. As a two-mode network of organizations rather than persons, the assumption of cognitive balance (Heider 1958) does not readily apply as it would in traditional definitions of transitivity and closure. Therefore, I call this measure of closure *affiliative transitivity* as it captures the interlocking nature of

affiliation in the network. In this network, higher values of affiliative transitivity correspond to more duplicated connections of agencies to each other through common support of the same colleges, and it identifies the potential for pooling resources and collaboration.

I also perform a subgroup analysis to understand the structure of the collaboration in the network. Following Borgatti et al (2018:231–32), I derive mutually exclusive subgroups using a clique co-membership matrix. Since this is a two-mode network, I analyze the number of bi-cliques using the biclique routine in UCINET. The default for the routine is three of each mode, but if one mode has significantly more vertices than the other, we can lower the threshold (Borgatti et al. 2018:278). I form mutually exclusive subgroups using the average method hierarchical clustering, maximizing the Girvan-Newman modularity of the cluster partitions. The composition of the groups provides additional insight on the most collaborative clusters of the network.

Results

Centrality

Table 1 provides the degree centrality scores for the top 20 mission agencies, ordered by dual-projected flow betweenness centrality. In the first two columns, I present the raw and re-normalized degree centrality which corresponds to the number and percent of colleges sponsored by mission agencies, respectively. The next three columns show the bipartite eigenvector, 2-step reach, and flow betweenness centrality measures. In the final column, I present the dual-projected flow betweenness centrality.

[Table 1 about here]

The top three agencies sponsoring the most colleges are the Presbyterian Board-USA (PN), the American Congregational Board (ABCFM), and the London Missionary Society (LMS), sponsoring 50%, 32%, and 27% of the Protestant union colleges throughout Asia, Africa, and Latin America, respectively. Of this top 20 list, 60% are American agencies. American missionaries were the most active in the Protestant higher educational network of the early 20th century, owing in large part to the expansion of mass higher education in the US around the turn of the century. It is surprising that American Congregationalists were so extended in supporting mission colleges into the 20th century given their significant loss of members to the Methodists and Baptists by the end of the 19th century (Finke and Stark 2005).

The top three agencies remain the same when considering eigenvector centrality, however some rank re-ordering takes place when considering 2-step reach centrality. As was discussed above, eigenvector centrality inflates a node's centrality when it is shares mutual connections with the nodes to which it is tied. This 2-step reach centrality is a normalized count of all of the unique nodes, both colleges and other agencies, that can be reached within two steps. We see that the LMS and ABCFM switch order, suggesting that the LMS may have some of these redundant ties. Also, several others rank much higher with 2-step reach centrality including the Church Missionary Society (CMS)—rank 4—and several women's agencies such as the Methodist society (MEFB*) and the Baptist society (ABF*), with ranks 5 and 6, respectively. On the one hand, that these mission agencies had more unique ties suggest they have broader influence. On the other hand, redundancy in ties may contribute to greater capacity to diffuse information and influence.

In analyzing the two methods of calculating flow betweenness, the differences are stark with respect to ordering.[2] While the Norwegian Lutheran Church (ANL) has the largest bipartite flow betweenness by far, it drops to fifth place in the dual-projected ranking. The Women's Board of Missions (ABCFM**) drops from 7th to 17th place in the dual-projected ranking. Others take a higher ranking, such as the Society for the Propagation of the Gospel (SPG), which is not in the top 20 of the regular flow betweenness order but ranks 8th in the dual-projected order. As the dual-projected approach takes into account the centrality of the colleges to which the agencies are linked, the dual-projected ordering highlights those agencies which sponsor only a few highly central colleges, such as is the case with SPG—it sponsors both Peking Union Medical College and Shantung Christian University, two of the most central colleges in the network. Figure 1 shows the two-mode network with nodes sized by dual-projected flow betweenness, providing a visualization of these flow dynamics. Agencies like ANL have lower flow betweenness in the dual-projected approach because, although they are a cutpoint between two components, one component is significantly smaller and therefore has less capacity to generate and receive information. Less information and resources can flow through ANL than if the two components were of equal size. Still, both measures are important for ecumenism in the network. ANL is highly important for connecting six other agencies and three colleges to the network, most of which are Lutheran.

[Figure 1 about here]

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[2] The Baptist Missionary Society scores 0 in normal flow betweenness but has a positive non-zero score in dual-projected flow betweenness. Everett (2016) also finds this for one of the women, Dorothy, in the Southern Women network.

Women's agencies play a significant role in terms of centrality. Several national denominations only have women's agencies supporting higher educational work (Church of Scotland, United Free Church of Scotland, the American United Lutheran church, and the Canadian Baptist church). When ranking by 2-step reach centrality, women's agencies make up about half of the top 20, with the Methodist agency (MEFB*) and the American Baptist agency (ABF*) at positions 5 and 6, respectively. These agencies are connected to several colleges with high degree centrality and through them to many other agencies not connected to by other means. MEFB*, ABF*, the Women's Board of the American Reformed church (RCA*) are more central than their denominational counterparts in terms of both 2-step centrality and eigenvector centrality. Also, when comparing women's auxiliaries (those women's agencies which were not fully independent of the main mission agency, indicated by an asterisk) to the main denominational mission agency, the women's auxiliaries are consistently more central, having more total ties and more unique ties.[3] In comparison to their main denominational mission boards, women's agencies contributed more to the interconnectivity of the network, enhancing the potential for collaboration and ecumenism around higher education.

With respect to dual-projected flow betweenness, six women's agencies are in the top 20. MEFB* is the highest ranked women's agency at 11th, though ranked slightly higher at 9th with normal flow betweenness. ABCFM** ranks 7th in normal flow betweenness but 17th in the dual-projected version. The second highest women's agency in dual-projected flow is ABF* at 13th, and the third is RCA* at 15th. Returning to Figure 2, we see that ABCFM** is quite remote in

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[3] The two exceptions are the American Congregationalists (ABCFM) and the Presbyterian Church of Canada (PCC). There are two women's Congregational auxiliaries. Combining them increases the number of unique ties to 15, however this still does not reach the 21 ties of the main ABCFM.

the network, hence its low dual-projected betweenness. This makes sense as ABCFM** primarily supported the American College for Girls in Constantinople, a prestigious school which increasingly became disconnected from religious aims and the missionary network (Reeves-Ellington 2015). As both MEFB* and ABF* were connected to women's Christian colleges in East Asia, they remain more central and well connected, as was more common to the higher educational network in East Asia (Sunquist 2001).

Turning to the colleges and universities, in Table 2 I provide the same centrality measures for the top 15, ordered by dual-projected flow betweenness. The top colleges represent the gamut of types of higher education initiatives—a general Christian university, seminary/theological colleges, medical colleges, and women's colleges. No one type dominates in terms of centrality. In terms of eigenvector centrality, Shantung Christian University is 1st, followed by the Evangelical Seminary of Mexico and three Chinese colleges—Union Theological College of Canton, Peking Union Medical College, and Ginling College. Both of these theological colleges would have been central sources of training for ministers, all of whom would have been male. When considering ranking by 2-step reach centrality, the order does not change much. There is more significant reordering at the bottom of the list, most notably Kinnaird College for Women (India) moves from 15th to 10th.

Comparing these localized centrality measures to the flow betweenness ordering, we find significant differences. Shantung Christian University remains at the top, but most of the colleges discussed above are not in the top 15. Dual-projected flow betweenness (by which the table is ordered) matches more closely the ordering of eigenvector and 2-step reach centrality, suggesting that these localized centrality measures take into account the centrality of colleges' alters better than the bipartite flow betweenness. Colleges and universities are the sites of

collaboration and pooling of resources by the mission agencies, so taking into account the centrality of the agencies makes a significant difference. Shantung Christian University is clearly the most central college in the network, even with two fewer sponsoring agencies than the top school. This is evident in Figure 1, which also shows the colleges (squares) sized by dual-projected flow betweenness. Most of the colleges with high dual-projected flow betweenness are in China, demonstrating its role in connecting the missionary education network together for collaboration and resource pooling.

[Table 2 about here]

Interestingly, one of the women's colleges, the Women's Christian College of India, has the highest degree centrality of all the colleges at 12 (25% of the agencies), Ginling College is fourth, and both the Women's Christian College of Japan and the Union Missionary Medical School for Women in India are tied with two other colleges for 5th place in degree centrality. Nearly half of the most popular colleges by degree were women's colleges, making them a significant potential site of network collaboration and the channeling of information and resources. In terms of dual-projected flow betweenness, two of the top 15 were in China, two were in India, and one was in Japan. Asia served not only as a site of collaboration and pooling of resources but also as a hub of information and resource flow for women's higher education.

In sum, there is good reason to expect that women's agencies and women's colleges helped foster network-wide collaboration and capacity for resource flow. Asia, and China in particular, were a primary locations for ecumenical work. There doesn't seem to be a single denomination driving collaboration, but there does seem to be a collection of denominations that play a large role. In the next section, I will step back to look at the network as a whole,

considering measures of cohesion for the whole network and without women's agencies and colleges. Then I will analyze subgroups in the network using core-periphery grouping.

Cohesion and Subgroups

In Table 3, I provide two-mode whole network measures for cohesion. The whole network is not very dense. The network is not very dense; only 8% of all possible ties are present in the network, accounting for the impossibility of within mode ties. Looking at the bipartite network, the average distance of the network is 3.94. An average geodesic path of 4 means that the shortest distances between agencies goes through two colleges and one other agency and vice versa for colleges. The diameter is 10, meaning that the longest shortest distance between an agency and college is 10 steps. With fragmentation of 0, we see that whole network is fully connected. The network has a transitivity of 0.47, which when combined with a density of 0.08 shows that this network is quite "clumpy." Agencies and colleges do not form a dense "hairball" but rather clump together in a web of knots, so to speak.

This has implications for the ecumenicity of the network. If the network were dense with low transitivity, then collaboration would be diffuse and purely decentralized, and resources would not likely pool in any part of the network. However, with low density and higher transitivity, it is likely that resource-rich agencies or colleges may pool their resources in a certain part of the network, and there would be more difficulty in spreading these resources out more broadly. On the one hand, this is a deterrent to ecumenism and potentially leads to further inequalities within the network. On the other hand, such clumpiness could contribute to more focused resource development in smaller tightly connected groups of agencies and colleges.

When removing women's mission agencies, the network becomes fragmented. Inspection of the graph shows that two women's colleges—American College for Girls at Constantinople

and Union Missionary Medical School for Women (India) are cut off from the network. The density increases slightly and the average distance decreases slightly, but not enough to draw any conclusions. When removing the women's colleges, there are more dramatic changes. The fragmentation increases to 0.39, suggesting that many nodes are disconnected from the network. Examining the graph shows that many of the women's agencies are disconnected from the network without these women's colleges. Finally, when removing both women's agencies and colleges, density increases to 0.10 and fragmentation is 0.10. Comparing the whole network to the network without women's colleges and agencies illustrates two important points. First, women's colleges played a critical role in connectivity in the network, but second, women's agencies were connected more to each other through women's colleges than to the rest of the network. This is to be expected since the women's missionary movement became wholly focused on women's education, separately from the main mission agencies, from the end of the 19th century through the early 20th century. If we had this network in the mid-19th century, we would likely find more women's agencies connected to general mission projects.

[Table 3 about here]

Next, I analyze the network in terms of subgroups. With 49 agencies and 34 colleges, a 3-2 ratio (3 agencies and 2 colleges) seems appropriate and provides 17 bi-cliques as compared to the two bi-cliques with the default approach, e.g. 3 nodes in each mode. The maximum Girvan-Newman modularity of the partitions derived from 3-2 bi-clique definition is 0.359, which is greater than with the maximum for the 3-3 bi-cliques at 0.179 or a 2-2 bi-clique at 0.247. This lends further support for the defining a bi-clique as 3 agencies and two colleges. Table 4 shows each bi-clique with the associated members. The Presbyterian Foreign Mission Board (PN) is in 13 bi-cliques, twice as many as the next two—the American Congregationalists (ABCFM) and

Shantung Christian University. The American women's Baptist agency (ABF*), the Methodist women's agency (MEFB*) and Ginling College all are in four cliques. The last four bi-cliques on the list have mostly women's agencies and colleges and have less overlap with the other bi-cliques. Just from looking at the bi-clique membership, we can begin to identify different overlapping groups of agencies and colleges. The results of the average similarity hierarchical clustering show five groups of agencies and colleges with a modularity of 0.359 and an average distance among nodes within the clusters of 0.125.

[Table 4 about here]

These five groups form discernable clusters of collaboration. The first group are two British agencies focusing on Tsinanfu Medical School in China. The second group is supporting two theological colleges in (North) Korea. The third is strictly the educational work of the American Methodist agency. The fourth group is a collection of mostly American women's agencies focused on women's colleges in India and China. The fifth is a group of agencies supporting a network of Chinese colleges. The remaining agencies and colleges did not form a distinct cluster based on clique comembership. These groups are displayed in color in Figure 2, with the remaining nodes in black. The list of groups are in the appendix.

[Figure 2 about here]

While these un-grouped agencies still have ties of collaboration to each other, they do not form the tight-knit clusters that were found through identifying the bi-cliques. These highly connected groups are instances of ecumenical collaboration and pooled resources in the case of groups two, four, five and to a more limited degree group one; however, they are instances of siloed intradenominational mission activity in the case of group one. Furthermore, the clustering of women's agencies in group four shows the independent and somewhat isolated work of

women's agencies in the network. In Figure 3, I allow NodeXL to lay out each group in its own

box, locking the non-grouped nodes in place, and I highlight women's agencies in bright red.

The mostly women's agencies group is top left. There are still a number of women's agencies

and colleges in the network that did not form a cluster.

[Figure 3 about here]

In sum, the cohesion and subgroup analyses reveal that mission agencies and colleges

clumped together in collaborative clusters in general, but less than half of all the colleges and

agencies formed distinct bi-cliques and clusters of collaboration. Women's colleges played an

important role in the connectivity of the network, but women's agencies tended to operate more

independently from the rest of the network.

Conclusion

Just as some transnational organizations and universities have more influence in

contemporary global civil society than others, so particular mission agencies and colleges feature

more prominently in this network. From the preceding analysis, we saw that the Presbyterian

mission agency is by far the most central according to multiple measures of network centrality,

followed by the Congregationalists, Lutherans, and Methodists. Women's mission agencies are

not generally the most central, though the Methodist Women's Board demonstrates high

localized centrality. On the mission field, China is the dominant location for mission

collaboration in higher education, and some of the most central colleges are women's colleges

such as the Women's Christian College in India and Ginling College in China. Considering the

network as a whole, women's colleges added to the interconnectivity of the network, but mostly

in terms of connections to other women's agencies, confirming the organizational implications of

the "separate spheres" ideology. The subgroup analysis revealed independent work by the

American Methodists and the importance of field location—China and India—or sending country—America—for establishing patterns of collaboration and pooling of resources.

As a principle, ecumenism is difficult to define, challenging to accomplish, and even more difficult to measure. In this study I attempted to measure ecumenical collaboration by common support of mission colleges. However, there are limitations to this approach. It is possible that joint support of a college represents competition rather than collaboration. It's also possible that common support of a college represents merely the popularity of the college and the potential for leverage in raising additional funds by promoting a well-known missionary college to congregants back home. Without more specific details on the nature of the tie between agencies and colleges, we cannot rule out these possibilities. However, mission agencies were involved in far more than higher education, and the resources required to support these colleges demanded some degree of focused cooperation and coordination. Additionally, given that the source material for this network data identifies these colleges and universities as products of union and cooperative efforts (Beach and Fahs 1925:11, 15), it is reasonable to assume that the vast majority of these ties are collaborative or at least indicators of cooperation.

The expansion of voluntary associations and effect of mass education on global civil society—especially women's efforts through Women's International Nongovernment Organizations (WINGO's) and the UN Decade on Women—is both a macro-level cultural transformation and product of a network of actors at the organizational and individual level. Coordination on such a global scale requires assumptions and ideals about the importance of coordinated action and the value of a unified vision. Protestant missionary societies of the early 20th century embodied these characteristics well before contemporary world polity, and understanding the role of organizational traditions, geographical contexts, and gendered

dynamics was as relevant then as it is now. From this study, we find interesting insight into the importance of China and America in shaping this transnational organizational network. Given contemporary problems between the two countries, these historical relations are worth noting. Protestant religion in China is strong—perhaps much stronger now than in 1900. Education in China is growing and internationalizing, following some American patterns. While missionary colleges were nationalized in the mid-20th century, the legacy is hard to overlook.

That women's colleges played such an important role in bringing together the missionary network should give some pause, given the eventual consolidation of women's mission agencies into the main mission boards. While one of the sources of this decline in independent women's mission agencies was changing attitudes of the women missionaries themselves (Robert 1996), one wonders whether the loss of such a robust network of agencies partly led to other declines in the movement. Research on the various stages of the women's movement struggles to account for the first wave's legacy given their relatively conservative gender norms, including a "separate spheres" ideology (Palmieri 1997; Taylor 1989). The importance of the women's missionary movement for women's colleges, but diminished role of women's agencies in the network, suggests that the loss of separate women's agencies was a loss for the network as a whole. Others have noted the somewhat paradoxical contribution of all-female organizations to the advancement of women's rights in the 19th and early 20th centuries and women's inclusion in male-dominated institutions (Freedman 1979; Taylor 1999). While times have changed, this analysis suggest that both full inclusion and parallel paths may provide distinct and equally valuable contributions to civil society, transnational associations, and higher education.

Table 1: Centrality Measures for Mission Agencies

Agency Name	Sending Country	Denomination	Degree	Renormalized Degree	Eigenvector	2-Step	Flow Betweenness	Dual-Projected Flow Betweenness
					Bipartite			
Board of Foreign Missions of the Presbyterian Church in the USA	USA	Presbyterian	17	0.50	1.000	0.55	814.53	801.59
London Missionary Society	England	Congregational	9	0.27	0.565	0.48	202.78	595.63
American Board of Commissioners for Foreign Mission	USA	Congregational	11	0.32	0.610	0.39	577.25	588.94
Board of Foreign Missions, Presbyterian Church of Canada	Canada	Presbyterian	5	0.15	0.347	0.23	37.48	384.17
Board of Foreign Missions of the Norwegian Lutheran Church of America	USA	Lutheran	3	0.09	0.109	0.20	1342.00	377.03
Executive Committee of Foreign Missions of the Presbyterian Church in the United States	USA	Presbyterian	5	0.15	0.307	0.24	47.79	352.76
Church Missionary Society for Africa and the East	England	Anglican	6	0.18	0.252	0.37	541.83	321.17
Society for the Propagation of the Gospel in Foreign Parts	England	Anglican	2	0.06	0.184	0.16	7.54	300.27
Foreign Missions Committee of Presbyterian Church of England	England	Presbyterian	2	0.06	0.118	0.13	18.67	254.95
Wesleyan Methodist Missionary Society	England	Methodist	2	0.06	0.118	0.13	18.67	254.95
Woman's Foreign Missionary Society of the Methodist Episcopal Church	USA	Methodist	6	0.18	0.351	0.33	100.03	254.02
Baptist Missionary Society	England	Baptist	1	0.03	0.102	0.12	0.00	253.03
Woman's American Baptist Foreign Mission Society	USA	Baptist	4	0.12	0.218	0.26	19.21	211.33
Board of Foreign Missions of the Methodist Episcopal Church	USA	Methodist	6	0.18	0.325	0.24	52.00	199.02
Woman's Board of Foreign Missions of the Reformed Church in America	USA	Reformed	3	0.09	0.137	0.22	12.73	170.51
United Christian Missionary Society	USA	Restorationist	4	0.12	0.277	0.22	18.98	148.64
Woman's Board of Missions (Congregational)	USA	Congregational	3	0.09	0.079	0.18	168.40	138.30

Women's Missionary Society of the United Lutheran Church in America	USA	Lutheran	2	0.06	0.076	0.17	6.40	132.52
Women's Auxiliary of the Wesleyan Methodist Missionary Society	England	Methodist	2	0.06	0.076	0.17	6.40	132.52
Board of Missions of the Methodist Episcopal Church, South	USA	Methodist	3	0.09	0.222	0.18	16.48	109.08

*Women's agencies are in bold.

Table 2: Centrality Measures for Universities and Colleges

Name	Degree	Bipartite Renormalized Degree	Eigenvector	2-Step	Flow Betweenness	Dual-Projected Flow Betweenness
Shantung Christian University	10	0.20	0.59	0.45	1788.52	1359.30
Union Theological College (Canton)	6	0.12	0.50	0.39	74.32	991.58
Union Lutheran Theological Seminary (Wuhan)	4	0.08	0.02	0.09	930.00	875.28
Women's Christian College (India)	12	0.25	0.34	0.34	833.49	848.07
Peking Union Medical College	6	0.12	0.48	0.37	211.20	752.54
Ginling College	7	0.14	0.47	0.35	100.89	694.67
Yenching Ta Hsueh [Peking University]	4	0.08	0.43	0.35	4.06	678.17
Evangelical Seminary of Mexico	8	0.16	0.50	0.38	361.00	657.91
Kinnaird College for Women	4	0.08	0.23	0.3	484.40	640.94
Women's Christian College of Japan	6	0.12	0.35	0.32	105.97	552.33
Bethesda Union Hospital	2	0.04	0.02	0.05	162.00	532.28
Fukien Christian University	4	0.08	0.22	0.26	55.38	509.55
Union Normal School for Women (Guangzhou)	4	0.08	0.31	0.3	209.83	471.63
Chosen Christian College	4	0.08	0.33	0.27	27.73	429.19
West China Union University	5	0.10	0.13	0.2	194.06	418.67

*Women's agencies are in bold.

Table 3: Whole Network Measures

	Whole Network	w/out Women's Agencies	w/out Women's Colleges	w/out Women's Agencies and Colleges
Density	0.08	0.09	0.07	0.10
Avg Distance	3.94	3.77	3.88	3.87
Diameter	10	10	10	10
Fragmentation	0.00	0.06	0.39	0.10
Affiliative Transitivity	0.47	0.47	0.51	0.51

Table 4: Bi-clique Membership

Bi-cliques	Members						
1	ABCFM	LMS	PCC	PN	Shantung Christian University	Union Theological College (Canton)	
2	ABCFM	LMS	PN	Peking Union Medical College	Shantung Christian University	Union Theological College (Canton)	Yenching Ta Hsueh [Peking University]
3	ABCFM	LMS	PN	SPG	Peking Union Medical College	Shantung Christian University	
4	ABCFM	PN	PS	Evangelical Seminary of Mexico	Shantung Christian University		
5	ABCFM	MEFB	PN	Evangelical Seminary of Mexico	Yenching TaHsueh [Peking University]		
6	ABCFM	PCNZ	PN	Union Normal School for Women (Guangzhou)	Union Theological College (Canton)		
7	ABF*	MEFB*	PN	UCMS	Ginling College	Women's Christian College of Japan	
8	AuPV	PCC	PN	PS	Presbyterian Union Theological Seminary (North Korea)	Union Christian College (North Korea)	
9	MEFB	MES	PN	Chosen Christian College	Evangelical Seminary of Mexico		
10	MES	PN	UCMS	Evangelical Seminary of Mexico	Ginling College		
11	LMS	MEFB*	PN	Ginling College	Peking Union Medical College		
12	PCC	PN	PS	Presbyterian Union Theological Seminary (North Korea)	Shantung Christian University	Union Christian College (North Korea)	
13	MEFB	PN	UCMS	Evangelical Seminary of Mexcico	University of Nanking		

14	ABCFM**	ABF*	RCA*	ULC*	WMMSW	Union Missionary Medical School for Women (India)	Women's Christian College (India)
15	EPM	PS	WMMS	Shantung Christian University	Tsinanfu Medical School		
16	ABF*	LMS	MEFB*	Ginling College	Women's Christian College of Japan		
17	ABF*	MEFB*	RCA*	Women's Christian College (India)	Women's Christian College of Japan		

Figure 1: Nodes Sized by Dual-projected Flow Betweenness
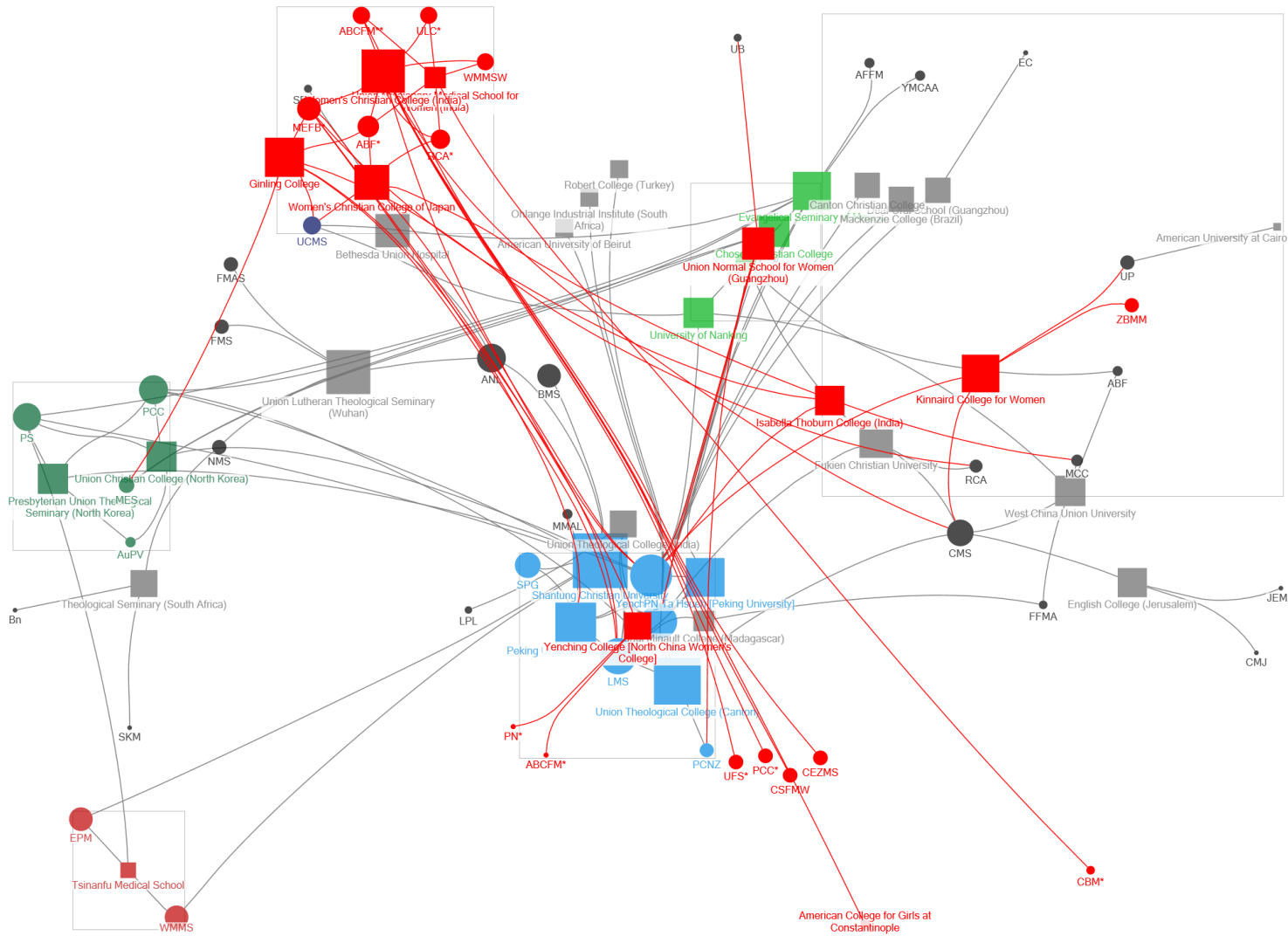
Figure 2: Hierarchically Clustered Groups by Bi-clique Comembership
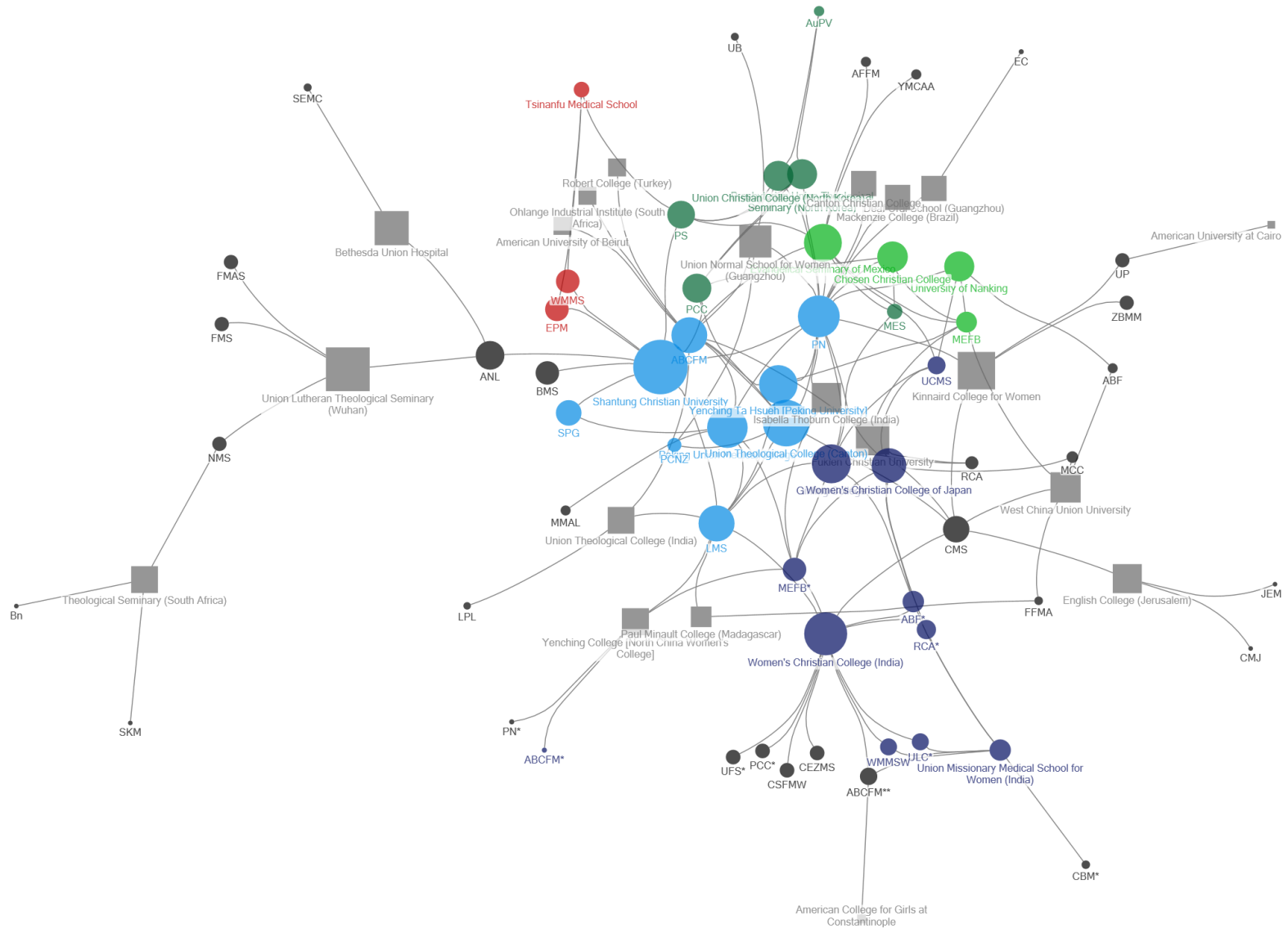
Figure 3: Groups Clustered with Women's Agencies and Colleges Highlighted

ABCFM* ULC*
WMMSW
Women's Christian College (India) Medical School for
SE Women (India)
MEFB
ABF* RCA*
Ginling College
Women's Christian College of Japan
UCMS
Bethesda Union Hospital
FMAS
FMS
Union Lutheran Theological Seminary (Wuhan)
PCC
PS
NMS
Union Christian College (North Korea)
Presbyterian Union Theological MES
Seminary (North Korea)
AuPV
Theological Seminary (South Africa)
Bn
SKM
EPM
Tsinanfu Medical School
WMMS

UB
AFFM
YMCAA EC
Robert College (Turkey)
Canton Christian College
Evangelical Seminary Mackenzie College (Brazil) School (Guangzhou)
Orlange Industrial Institute (South Chosen Christian College
Africa) Union Normal School for Women
American University of Beirut (Guangzhou)
University of Nanking
American University at Cairo
UP
ZBMM
ANS
BMS ABF
Kinnaird College for Women
Isabella Thoburn College (India)
Fukien Christian University
MCC
RCA
West China Union University
MMAL
Union Theological College (India) CMS
SPG Shantung Christian University
Peking PN Ta Hsueh [Peking University] English College (Jerusalem) JEM
LPL Mainault College (Madagascar) FFMA
Peking Yenching College [North China Women's CMJ
College]
LMS
Union Theological College (Canton)
PN*
ABCFM* PCNZ
UFS* PCC* CEZMS
CSFMW
CBM*
American College for Girls at
Constantinople

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Appendix

Hierarchically Clustered Groups by Bi-Clique Comembership

Group	Color	Name
1	Red	EPM
1	Red	WMMS
1	Red	Tsinanfu Medical School
2	Dark Green	AuPV
2	Dark Green	PCC
2	Dark Green	PS
2	Dark Green	Presbyterian Union Theological Seminary (North Korea)
2	Dark Green	Union Christian College (North Korea)
3	Light Green	MEFB
3	Light Green	MES
3	Light Green	Chosen Christian College
3	Light Green	Evangelical Seminary of Mexico
3	Light Green	University of Nanking
4	Dark Blue	ABCFM**
4	Dark Blue	ABF*
4	Dark Blue	MEFB*
4	Dark Blue	RCA*
4	Dark Blue	UCMS
4	Dark Blue	ULC*
4	Dark Blue	WMMSW
4	Dark Blue	Ginling College
4	Dark Blue	Union Missionary Medical School for Women (India)
4	Dark Blue	Women's Christian College (India)
4	Dark Blue	Women's Christian College of Japan
5	Light Blue	ABCFM
5	Light Blue	LMS
5	Light Blue	PCNZ
5	Light Blue	PN
5	Light Blue	SPG
5	Light Blue	Peking Union Medical College
5	Light Blue	Shantung Christian University
5	Light Blue	Union Normal School for Women (Guangzhou)
5	Light Blue	Union Theological College (Canton)
5	Light Blue	Yenching Ta Hsueh [Peking University]

Agency	Name	Country	Denomination
ABCFM	American Board of Commissioners for Foreign Mission	USA	Congregational
ABCFM*	Woman's Board of Missions of the Interior (Congregational)	USA	Congregational
ABCFM**	Woman's Board of Missions (Congregational)	USA	Congregational
ABF	American Baptist Foreign Mission Society	USA	Baptist
ABF*	Woman's American Baptist Foreign Mission Society	USA	Baptist
AFFM	American Friends Board of Foreign Missions	USA	Quaker
ANL	Board of Foreign Missions of the Norwegian Lutheran Church of America	USA	Lutheran
AuPV	Foreign Missions Committee of Presbyterian Church of Victoria	Australia	Presbyterian
BMS	Baptist Missionary Society	England	Baptist
Bn	Berlin Missionary Society	Germany	Evangelical
CBM*	United Baptist Woman's Missionary Union of the Maritime Provinces, Canada	Canada	Baptist
CEZMS	Church of England Zenana Missionary Society	England	Anglican
CMJ	Church Mission to Jews	England	Anglican
CMS	Church Missionary Society for Africa and the East	England	Anglican
CSFMW	Church of Scotland Women's Association for Foreign Mission	Scotland	Presbyterian
EC	Missionary Society of the Evangelical Church	USA	Evangelical
EPM	Foreign Missions Committee of Presbyterian Church of England	England	Presbyterian
FFMA	Friends Foreign Mission Association	England	Quaker
FMAS	Board of Foreign Missions of the Augustana Synod	USA	Lutheran
FMS	Finnish Missionary Society	Finland	Lutheran
JEM	Jerusalem and the East Mission	England	Anglican
LMS	London Missionary Society	England	Congregational
LPL	Commitee for L.P. Larsen's Missionary Work among Students in India	Canada	Lutheran
MCC	Missionary Society of the Methodist Church	Canada	Methodist
MEFB	Board of Foreign Missions of the Methodist Episcopal Church	USA	Methodist
MEFB*	Woman's Foreign Missionary Society of the Methodist Episcopal Church	USA	Methodist
MES	Board of Missions of the Methodist Episcopal Church, South	USA	Methodist
MMAL	Medical Missionary Association of London	England	Presbyterian
NMS	Norwegian Missionary Society	Norway	Lutheran
PCC	Board of Foreign Missions, Presbyterian Church of Canada	Canada	Presbyterian
PCC*	Woman's Foreign Missionary Society of the Presbyterian Church in Canada	Canada	Presbyterian
PCNZ	Foreign Missions Committee of the Presbyterian Church of New Zealand	New Zealand	Presbyterian

PN	Board of Foreign Missions of the Presbyterian Church in the USA	USA	Presbyterian
PN*	Woman's Board of Foreign Missions of the Presbyterian Church in the U.S.A.	USA	Presbyterian
PS	Executive Committee of Foreign Missions of the Presbyterian Church in the United States	USA	Presbyterian
RCA	Board of Foreign Missions of the Reformed Church in America	USA	Reformed
RCA*	Woman's Board of Foreign Missions of the Reformed Church in America	USA	Reformed
SEMC	Swedish Evangelical Mission Covenant of America	USA	Evangelical
SKM	Church of Sweden Mission	Sweden	Lutheran
SPG	Society for the Propagation of the Gospel in Foreign Parts	England	Anglican
UB	Foreign Mission Society of the United Brethren in Christ	USA	Bretheren
UCMS	United Christian Missionary Society	USA	Restorationist
UFS*	United Free Church of Scotland Women's Foreign Mission	Scotland	Presbyterian
ULC*	Women's Missionary Society of the United Lutheran Church in America	USA	Lutheran
UP	Board of Foreign Missions of the United Presbyterian Church of North America	USA	Presbyterian
WMMS	Wesleyan Methodist Missionary Society	England	Methodist
WMMSW	Women's Auxiliary of the Wesleyan Methodist Missionary Society	England	Methodist
YMCAA	International Committee of the Young Men's Christian Associations, Foreign Department	USA	Independent
ZBMM	Zenana Bible and Medical Mission	England	Independent