

# Examining stigma dynamics: a scoping review of social network analysis in communicable disease contexts

Izyan Hazwani Baharuddin<sup>1,2</sup>, Nurhuda Ismail<sup>1</sup>, Megan S. Patterson<sup>3</sup>, Siti Munira Yasin<sup>1</sup>,  
Nyi Nyi Naing<sup>4</sup>, Khalid Ibrahim<sup>1</sup>

<sup>1</sup>Department of Public Health Medicine, Faculty of Medicine, Universiti Teknologi MARA Selangor Campus, Shah Alam, Malaysia

<sup>2</sup>Faculty of Dentistry, Universiti Teknologi MARA Selangor Campus, Shah Alam, Malaysia

<sup>3</sup>Department of Health Behavior, Texas A&M University, College Station, United States

<sup>4</sup>Faculty of Medicine, Universiti Sultan Zainal Abidin, Kuala Terengganu, Malaysia

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## ABSTRACT

The global COVID-19 pandemic has brought attention to the profound impact of stigma on individuals, communities, and societies. Social network analysis (SNA), based on network theory, offers a transformative approach to investigate the complex interplay of social structures, relationships, and information dissemination in communicable disease contexts. This scoping review aims to examine the utilization of SNA in studying stigma dynamics related to communicable diseases, assess the current research landscape, identify gaps, and highlight key findings. Three databases (Scopus, Web of Science, and PubMed) were searched for studies on SNA and stigma in communicable diseases. From the identified studies, three eligible articles were selected for review, providing insights into the role of stigma as a barrier to social integration, thereby impacting network centrality. The review also explores patterns of stigma communication on social media and examines the impact of interventions on individuals' social networks. Overall, this review emphasizes the value of SNA in comprehending the intricate relationships between social networks and stigma in communicable disease contexts.

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## Corresponding Author:

Nurhuda Ismail

Department of Public Health Medicine, Faculty of Medicine, Universiti Teknologi MARA Selangor  
Campus, Hospital Street, Sungai Buloh-47000, Selangor, Malaysia

Email: yuda@uitm.edu.my

## 1. INTRODUCTION

Social network analysis (SNA), which originates from network theory, presents itself as a robust approach to examining the intricacies and trends of connections within social structures. By shedding light on the pathways through which information, influence, and behavior move within social networks, this analytical instrument not only provides valuable insights into the network architecture but also offers a fresh lens through which to analyze the intricate interplay between social structures, information flow, and relationships [1], [2]. Moreno's seminal research on sociograms in 1934 established the fundamental principles that underpin SNA, underscoring its capacity to illuminate group dynamics and social interactions [2].

SNA enables the quantitative analysis, visualization, and mapping of network features like density, connectedness, and centrality; thus, it provides crucial insights into the dissemination processes of diverse phenomena across networks [3], [4]. Through the use of SNA, scholars have the ability to reveal the invisible structure of social networks, elucidating the complex network of relationships, influences, and actions that contribute to the dissemination and repercussions of social phenomena [5]. Researchers can gain insights into

the functions of influential individuals, opinion leaders, and key players in social networks by employing SNA [6]. This enables them to discern the ways in which these individuals distribute information, mould collective sentiments, and impact societal standards. The identification of these essential actors was based on their elevated degrees of centrality, their ability to serve as intermediaries between various network segments, or their influential positions within clusters [7]–[9].

SNA has been implemented in sociology, psychology, and public health, among other disciplines [10]–[12]. The application of SNA in public health highlights its utility in addressing health-related issues, from understanding the spread of diseases to designing effective interventions [13]. The analytical framework utilized for investigating health systems highlights the importance of SNA in identifying and representing the collaborative interactions that occur within healthcare environments [14]. Previous studies have employed SNA to investigate obesity, demonstrating how network analysis can provide insights into the social determinants and peer effects that contribute to obesity, further extending the scope of SNA beyond traditional fields [15].

Communicable diseases are those that are capable of being spread from one individual to another via various means, including but not limited to direct contact, respiratory droplets, or contaminated objects [16]. Prominent instances of communicable diseases include COVID-19, influenza, HIV/AIDS, and tuberculosis. SNA was widely utilized in numerous research during the height of the COVID-19 pandemic to trace the disease's progress and aid in contact tracing efforts [17]–[20]. These diseases pose significant public health challenges due to their potential for rapid spread within communities and population [21]. The significance of SNA is especially evident in light of the worldwide COVID-19 pandemic, which not only presents a substantial risk to public health but also draws attention to the complex matter of stigma [22], [23].

Stigma is defined as a negative social phenomenon that affects individuals, groups, and society as a whole [22], [24]–[26]. Stigmatization, apart from the immediate repercussions of the illness, gives rise to increased apprehension, the propagation of false information, prejudice, and social isolation [27]–[29]. In order to achieve a thorough understanding of the complex dynamics of stigma surrounding contagious diseases, it is imperative to use a comprehensive approach that goes beyond superficial views. Through the utilization of SNA in stigma studies concerning communicable diseases, substantial insight can be acquired regarding the intricate social mechanisms and network dynamics that either exacerbate or mitigate stigma. With a focus on communicable diseases, this scoping review aims to investigate the use of SNA in stigma research in order to better understand the intricate relationship between social networks and stigma.

## 2. METHOD

This scoping review was conducted following the preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-ScR) guidelines to ensure clarity and transparency in the reporting of the review [30]. Following these guidelines offers a systematic framework that improves the review process's replicability and methodological rigor, which in turn contributes to the validity and reliability of the findings. Additionally, the application of PRISMA-ScR guarantees that all crucial elements of the scoping review are methodically addressed, making it easier to find, pick, and synthesize pertinent studies in an impartial and thorough manner.

### 2.1. Search strategy

In June 2023, an extensive search was conducted across three prominent databases: Scopus, Web of Science, and PubMed. Employing a strategic approach, specific keywords “social network analysis” and “stigma” were combined using Boolean operators to enhance search precision. The results of this comprehensive search strategy are detailed in Table 1.

Table 1. Keywords and search strategy

Database	Keywords	Number of articles
Scopus	(TITLE-ABS-KEY (“social network analysis”) AND TITLE-ABS-KEY (stigma))	26
Web of Science	stigma (Title) AND “social network analysis” (All Fields)	5
PubMed	((stigma [Title/Abstract])) AND (“social network analysis”)	13

### 2.2. Inclusion criteria

To ensure the selection of relevant studies, the following inclusion criteria were applied. These criteria were designed to filter studies that align with the research objectives. Through this, only studies meeting the following criteria were included in this review: i) utilization of SNA: Studies that utilized SNA as a primary methodology or as a significant component in investigating stigma dynamics in the context of communicable

diseases were included. In this case, SNA requires the exploration and/or analysis of dyadic data; ii) relevance to communicable diseases: Studies that focused on communicable diseases, including but not limited to COVID-19, HIV/AIDS, tuberculosis, malaria, and other infectious diseases; iii) stigma as a primary or significant outcome: Studies that explicitly examined stigma, including its measurement, conceptualization, transmission, or effects within social networks; vi) empirical research: Only empirical research studies, including quantitative, qualitative, and mixed-method designs, were included; and v) published in English.

### 2.3. Exclusion criteria

To narrow down the selection of studies, the following exclusion criteria were employed. These criteria aided in excluding studies that didn't fit the established criteria. By using these exclusion criteria, we ensured that only the most appropriate studies were included in our review: i) review articles, commentaries, and editorials were excluded; ii) non-communicable diseases: Studies that primarily focused on non-communicable diseases, such as mental health stigma, were excluded; iii) irrelevant methodology: Studies that did not employ SNA or did not have a substantial focus on the role of social networks in stigma dynamics were excluded; and iv) non-English language.

### 2.4. Study selection process

The study selection process comprised four stages: i) study identification through databases, ii) study screening where duplicates were removed, iii) title/abstract screening, and iv) full-text review. Two independent reviewers conducted the screening process, with discrepancies resolved through discussion and consensus. Following screening, titles and abstracts of identified articles were screened against the inclusion and exclusion criteria. Studies that met the criteria or had insufficient information to make a decision were included for full-text review. Next, the full texts of selected articles were assessed to determine their eligibility for final inclusion in the scoping review.

### 2.5. Data extraction

A standard form was created to gather important details from the included studies. This form assisted us in collecting specific data points necessary for our review. Subsequently, we extracted the following information from each study: i) study characteristics: Author(s), year of publication, title, journal, and country of origin; ii) research aim/objective: The primary focus or research question of the study; iii) methodology: Description of the study design, data collection methods, and analytical approaches employed; iv) type of communicable disease: The specific infectious disease under investigation in the study; v) stigma outcome: The identified outcomes related to stigma dynamics within social networks in the context of communicable disease; vi) sample size: The number of participants or entities included in the study; and v) key findings: Summary of the main findings related to stigma dynamics within social networks in the context of communicable disease.

### 2.6. Data synthesis and quality assessment

A narrative synthesis approach was employed to summarize and present the findings from the included studies, focusing on the elucidation of key themes, concepts, and patterns that emerged from the data. This method facilitated a deeper understanding of the data, allowing for the integration of quantitative and qualitative findings and the exploration of heterogeneities within the studied phenomena. The identified themes and patterns were meticulously organized to provide a comprehensive overview of the application of social network analysis in stigma research, specifically within the context of communicable diseases [31].

Scoping reviews, regardless of quality, are intended to provide an overview of the available literature [32]. Therefore, no formal assessment of the quality of the included studies was carried out. However, a reflective assessment of the methodological rigor and relevance of the included studies was incorporated. This reflective assessment served not as a barrier to inclusion but as a means to critically appraise each study's contributions to understanding stigma dynamics through SNA. The reflective assessment considered aspect study design and methodology, context and setting, sampling and participation, and findings and conclusion [33], [34].

## 3. RESULTS AND DISCUSSION

A total of 44 articles were identified through the search strategy from the Scopus, Web of Science and PubMed databases. After applying the inclusion and exclusion criteria, 6 articles underwent full-text review. Ultimately, 3 articles met the eligibility criteria and were included in the scoping review as shown in Figure 1.

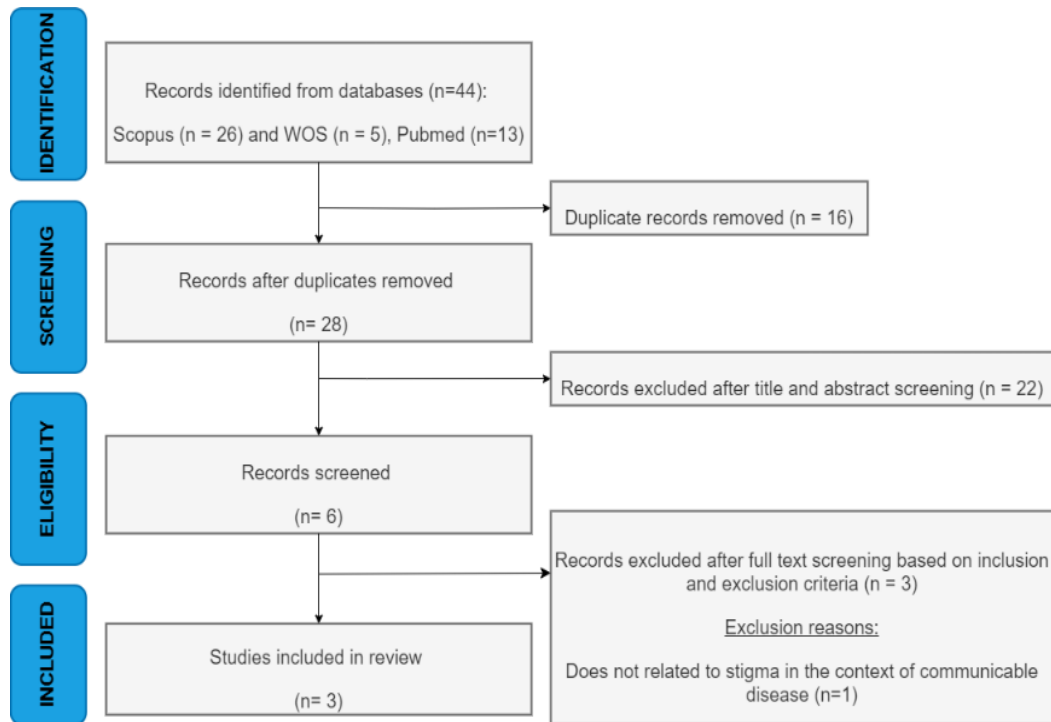


Figure 1. PRISMA flow chart

### 3.1. Characteristics of included studies

Studies that met the inclusion and exclusion criteria of this scoping review are presented in Table 2. From these selected articles, various key findings have emerged, shedding light on the benefits of applying SNA in stigma research within the context of communicable diseases.

Table 2. Summary of included studies

Study	First author	Year	SNA related study aim	Methodology	Communicable Diseases	Stigma Outcome	Sample size
Study 1 [35]	Rachel A. Smith	2012	To investigate and understand the dynamics of HIV stigma and centrality within a community's social network in Namibia	Qualitative-Interview	HIV/AIDS	Perceived HIV stigma	375
Study 2 [8]	Sushma Kumble	2021	To uncover stigma communication patterns, identify key actors and gatekeepers within the Twitter network, understand the influence of social media influencers on stigma-related narratives, and explore the role of health organizations in stigma mitigation	Quantitative-Content analysis of Twitter	COVID-19	Spread of stigma and information messages	3,056 (tweets)
Study 3 [36]	Laura M. Bogart	2020	To explore the impact of the intervention on the social networks of individuals living with HIV.	Pilot randomized controlled trial (Phase 2)	HIV	Internalized HIV stigma, Anticipated HIV stigma, Concerns about disclosure	99 (index partici, 58 alters

### 3.2. Key findings identified

The following key findings have been extracted from the selected studies:

#### 3.2.1. Stigma as barrier to social integration

Conducted in Namibia, study 1 employed social network analysis techniques to examine the centrality of individuals within a specific Namibian community's social network and its relationship with HIV stigma [35]. The findings revealed that stigma acted as a significant barrier to social integration for

people living with HIV in the Namibian community. The study also revealed that individuals who perceived both greater HIV risk and greater HIV stigma tended to participate in fewer community groups. Moreover, these individuals were connected to community groups that had limited participation across the network. In contrast, individuals who perceived greater HIV risk but less HIV stigma showed higher levels of participation in community groups. They were also associated with community groups that occupied a greater share of the paths between entities in the network.

This finding supports the importance of considering both risk perceptions and stigma in designing interventions and support programs to address social exclusion and enhance community integration [37]. Addressing the complex interplay between stigma, network centrality, and the desire for secrecy in stigma-reduction interventions becomes critical, particularly as a strategy to cope with stigma by association. Similar studies suggest that individuals reporting higher efficacy in resisting HIV stigma exhibit greater centrality within the network, signifying their influential role in spreading stigma resistance throughout the community.

### 3.2.2. Stigma dynamics and network centrality

Study 1 sheds light on the complex dynamics between stigma, network centrality, and the impact of secrecy desires. Individuals associated with people living with HIV/AIDS (PLWHA) and desiring greater secrecy about a family member's HIV-positive diagnosis exhibited lower degrees of centrality within the network [35]. This finding suggests the presence of courtesy stigma or stigma by association, leading individuals to participate in smaller, more selective parts of the community network. The desire for family secrecy regarding HIV diagnoses may serve as a strategy to address the stigma-by-association phenomenon.

Additionally, the study revealed that individuals perceiving HIV as tabooer and holding stronger HIV/AIDS stigma beliefs exhibited higher degrees of centrality within the community network. However, individuals who reported greater efficacy in resisting HIV stigma demonstrated higher centrality within the network. Additionally, the study revealed that individuals perceiving HIV as tabooer and holding stronger HIV/AIDS stigma beliefs exhibited higher degrees of centrality within the community network. This may be indicative of community groups with stronger stigma beliefs rejecting individuals deemed deviant, thereby increasing their centrality within the network. Similar to the research conducted by Tsai *et al.* [38], results from this review emphasize the critical role of addressing the complex interplay between stigma, network centrality, and the desire for secrecy in stigma-reduction interventions, particularly as a strategy to cope with stigma by association [35].

### 3.2.3. Significance of community groups

The community groups with the highest centrality in study 1 were churches, a church-affiliated AIDS action group, and shebeens (bars) [35]. The authors suggested that these organizations play a significant role in the social life of the community and are potentially important in the context of HIV/AIDS interventions. They also proposed that limited participation in such groups may be due to the stigma associated with being associated with HIV/AIDS. The findings from study 1 were further supported by Dijker and Koomen suggesting that community groups with stronger stigma beliefs may reject individuals deemed deviant, thereby increasing their centrality within the network [39]. Similarly, study 1 corroborated the results of Kollmann *et al.* [40], which demonstrated that individuals reporting higher efficacy in resisting HIV stigma exhibited greater centrality within the network, signifying their influential role in spreading stigma resistance throughout the community. The results of study 1 reinforced the significance of inter-organizational collaboration and cooperation in ensuring effective interventions and support for individuals who transcend barriers imposed by stigma [35], [41].

### 3.2.4. Patterns of stigma communication

Study 2 aimed to investigate patterns of stigma communication and influential actors in the context of COVID-19 [8]. The study focused on Twitter conversations related to communicable diseases, particularly COVID-19. Through the analysis of various types of stigmatizing cues embedded in tweets, including peril, etiology, and labeling, the study revealed the specific elements of stigma associated with emerging infectious diseases. This provided unique insights into the patterns of stigma communication regarding COVID-19 on Twitter and shed light on how stigma is manifested and communicated within social media platforms.

### 3.2.5. Influential actors in stigma communication

Study 2 also identified influential actors and gatekeepers within the Twitter network who played a crucial role in shaping the discourse around COVID-19 stigma [8]. These figures included media outlets, health organizations, influencers, and laypeople, wielding the power to construct and disseminate stigma-related information, influencing public perceptions and reinforcing stigmas. Social media influencers, in particular, were found to be influential in shaping stigma narratives and perceptions related to COVID-19.

These findings underscore the importance of understanding the role of influencers in shaping public discourse and the potential implications of their actions. The persuasive power of social media influencers in shaping stigma-related narratives on Twitter were supported by findings by Harff *et al.* [42] that influencers can be instrumental in disseminating accurate information and promoting positive behavior changes. Therefore, it becomes crucial for influencers to exercise caution and responsibility in sharing content related to communicable diseases and align their messages with evidence-based public health guidelines [43]. Collaborating with influencers to ensure accurate information dissemination and stigma reduction efforts can be an effective strategy in mitigating the negative impact of stigma on public health outcomes [44].

### **3.2.6. Role of health organizations in stigma mitigation**

Health organizations, especially healthcare organizations, were identified as key actors within the social network in stigma mitigation. Study 2 emphasized their important role in addressing and reducing stigma associated with infectious diseases [8]. Recommendations were made for health organizations to actively monitor their social media accounts, promptly address stigma-laden messages, and periodically disseminate de-stigmatization messages. Leveraging the insights gained through social network analysis, health organizations can actively contribute to reducing stigma, encouraging appropriate healthcare-seeking behavior, and supporting effective public health responses [45].

### **3.2.7. Effectiveness of intervention approach in addressing stigma and promoting advocacy**

Study 3 focuses on an intervention approach to address stigma and promote advocacy among individuals living with HIV in Uganda, referred to as the Game Changers intervention [36]. The study reveals improvements in several key areas, including internalized HIV stigma, anticipated HIV stigma, concerns about disclosure, serostatus disclosure, prevention advocacy, social network dynamics, and the influence on alters within participants' social networks. The Game Changers intervention significantly increased serostatus disclosure and empowered participants to engage in open discussions about their HIV status within their social networks, emphasizing the importance of disclosure for advocating HIV prevention and fostering supportive relationships. Additionally, the intervention positively influenced HIV prevention advocacy, with participants in the intervention group having more frequent discussions about HIV-related topics compared to the control group. Most importantly, the intervention influenced social network dynamics. Compared to the control group, intervention participants experienced less change in network density over time, indicating the maintenance of social connections.

### **3.2.8. Impact on alters**

Study 3 demonstrated that although the intervention focused on index participants of the Game Changers, there were indications that alters (individuals within the social networks of index participants) were also affected [36]. Alters in the intervention group exhibited increased prevention advocacy and marginally lower levels of condomless sex compared to the control group. These findings supported that intervention had potential spillover effects, influencing the behaviors and attitudes of individuals within the social networks of index participants [46].

## **3.3. Research gaps and future research**

Stigma is a pervasive social phenomenon that has garnered significant attention during the global COVID-19 pandemic [47]. However, despite these evidence [8], [35], [36], the exploration of stigma through SNA within the context of communicable diseases remains limited. The findings from the reviewed articles provide valuable insights into how SNA can be effectively employed to unravel the complex relationship between stigma and communicable diseases.

While SNA has been widely used in the context of studying the spread of communicable diseases such as COVID-19 [17], [19], [20], there is growing evidence to suggest that stigma towards the diseases can also spread through social networks, just like the disease itself [8], [35], [36]. However, this scoping review, while offering valuable insights into the utilization of social network analysis in the study of stigma dynamics related to communicable diseases, identifies several areas that warrant further investigation.

First, the identified studies were focused on HIV/AIDS and COVID-19-related stigma, indicating potential bias towards these diseases. Given that there were only three studies in the body of literature, there is room for more exploration of SNA and stigma relative to communicable diseases, including other infectious diseases such as tuberculosis, malaria, and emerging infectious diseases. Expanding research to include a broader range of communicable diseases would provide a more comprehensive understanding of stigma dynamics across different contexts and populations. Moreover, the diffusion methodology for tracking information spread over social interaction structures opens new avenues for understanding how stigma related to communicable diseases proliferates within and across communities [48]. This approach not only

emphasizes the role of network topology in the diffusion process but also highlights the potential for individual nodes within a network to significantly influence the spread of stigma, similar to the spread of the diseases themselves.

Additionally, future research should prioritize the exploration of social network analysis for comprehending stigma dynamics across varied cultural and geographical landscapes. The perception of stigma and its ramifications on social networks can significantly differ among diverse populations and contexts. Delving into these variations can yield insights that pave the way for targeted and context-specific interventions, aimed at effectively combating stigma. Furthermore, the investigation into the role of digital platforms and social media in the communication of stigma during outbreaks of communicable diseases warrants urgent attention. Given the prevalent reliance on social media as a primary conduit for information and communication in the midst of public health emergencies, grasping the mechanisms through which stigma is propagated and entrenched within online networks becomes crucial [49]–[51]. Such understanding is imperative for the formulation of strategies that effectively counter misinformation and the perpetuation of stigma.

### 3.4. Strengths of included studies and review

The strength of the included studies lies in their use of social network analysis as a powerful methodology to explore stigma dynamics within the context of communicable diseases. By leveraging network theory and quantitative analysis, these studies provide valuable insights into the underlying architecture of social networks and the ways in which stigma spreads, consolidates, or is resisted within these networks. Moreover, this scoping review follows the PRISMA-ScR guidelines, ensuring transparency and rigor in the review process [30]. The comprehensive search strategy across multiple databases and the use of inclusion and exclusion criteria contribute to the completeness and relevance of the included studies.

### 3.5. Limitations of the scoping review

Despite its contributions, this scoping review has some limitations. One major limitation is the small number of eligible studies identified during the search process. This could be attributed to the emerging nature of research applying social network analysis specifically to the study of stigma in communicable disease contexts. As a result, the findings from the included studies may not fully capture the breadth and depth of the application of social network analysis in this area. Furthermore, the focus on English-language publications may have led to the exclusion of relevant studies published in other languages. Additionally, the lack of quality assessment of the included studies is another limitation. While scoping reviews do not typically conduct formal quality assessments [32], acknowledging this limitation is essential for interpreting the findings.

## 4. CONCLUSION

This review highlights the diverse ways in which social network analysis has been applied to explore stigma dynamics. The findings emphasize the importance of addressing stigma not only at the individual level but also within the context of social networks, where it can spread, morph, and impact entire communities. As the world continues to grapple with communicable diseases, combating stigma remains a pressing public health challenge. This scoping review calls for the need for more research utilizing SNA in this context to foster inclusive, empathetic societies. By doing so, we can enhance our understanding of the complexities of stigma, identify effective interventions, and ultimately contribute to the global efforts to combat communicable disease stigma.

## REFERENCES

- [1] N. Haagenen and L. F. Henriksen, *Social network analysis: the significance of relations*. 2021.
- [2] J. L. Moreno, *Who shall survive?: A new approach to the problem of human interrelations*. Washington: Nervous and Mental Disease Publishing Co, 1934, doi: 10.1037/10648-000.
- [3] T. W. Valente, *Social networks and health*. Oxford University Press New York, 2010, doi: 10.1093/acprof:oso/9780195301014.001.0001.
- [4] S. Wasserman and K. Faust, *Social network analysis*. Cambridge University Press, 1994, doi: 10.1017/CBO9780511815478.
- [5] A. M. Dozier *et al.*, “Identifying emerging research collaborations and networks,” *Evaluation and the Health Professions*, vol. 37, no. 1, pp. 19–32, Mar. 2014, doi: 10.1177/0163278713501693.
- [6] E. Rice, E. Tulbert, J. Cederbaum, A. Barman Adhikari, and N. G. Milburn, “Mobilizing homeless youth for HIV prevention: a social network analysis of the acceptability of a face-to-face and online social networking intervention,” *Health Education Research*, vol. 27, no. 2, pp. 226–236, Apr. 2012, doi: 10.1093/her/cyr113.
- [7] T. W. Valente, K. Coronges, C. Lakon, and E. Costenbader, “How correlated are network centrality measures?,” *Connections (Toronto, Ont.)*, vol. 28, no. 1, pp. 16–26, 2008.
- [8] S. Kumble and P. Diddi, “Twitter conversations about COVID-19 during pre-pandemic period: Stigma and information format cues,” *Stigma and Health*, vol. 6, no. 3, pp. 251–262, Aug. 2021, doi: 10.1037/sah0000324.




- [9] R. Cross, S. P. Borgatti, and A. Parker, "Beyond answers: dimensions of the advice network," *Social Networks*, vol. 23, no. 3, pp. 215–235, Jul. 2001, doi: 10.1016/S0378-8733(01)00041-7.
- [10] J. Verdouw and K. Flanagan, "‘I call it the dark side’: Stigma, social capital and social networks in a disadvantaged neighbourhood," *Urban Studies*, vol. 56, no. 16, pp. 3375–3393, Dec. 2019, doi: 10.1177/0042098018817226.
- [11] D. Michalko, J. Plichtová, and A. Šestáková, "Network analysis approach for exploring dementia representations in the Slovak media," *Dementia*, vol. 21, no. 3, pp. 781–793, Apr. 2022, doi: 10.1177/14713012211054971.
- [12] L. D. Silva, S. Strobbe, J. L. de Oliveira, L. Y. de Almeida, M. Cardano, and J. de Souza, "Social support networks of users of crack cocaine and the role of a Brazilian health program for people living on the street: A qualitative study," *Archives of Psychiatric Nursing*, vol. 35, no. 5, pp. 526–533, Oct. 2021, doi: 10.1016/j.apnu.2021.06.010.
- [13] T. W. Valente and S. R. Pitts, "An appraisal of social network theory and analysis as applied to public health: Challenges and opportunities," *Annual Review of Public Health*, vol. 38, no. 1, pp. 103–118, Mar. 2017, doi: 10.1146/annurev-publhealth-031816-044528.
- [14] A. De Brún and E. McAuliffe, "Social network analysis as a methodological approach to explore health systems: A case study exploring support among senior managers/executives in a hospital network," *International Journal of Environmental Research and Public Health*, vol. 15, no. 3, Mar. 2018, doi: 10.3390/ijerph15030511.
- [15] S. Zhang, K. de la Haye, M. Ji, and R. An, "Applications of social network analysis to obesity: A systematic review," *Obesity Reviews*, vol. 19, no. 7, pp. 976–988, Jul. 2018, doi: 10.1111/obr.12684.
- [16] "Communicable diseases," World Health Organization (WHO) African Region. Accessed: Jun. 28, 2023. [Online]. Available: <https://www.afro.who.int/health-topics/communicable-diseases>.
- [17] S. Saraswathi, A. Mukhopadhyay, H. Shah, and T. S. Ranganath, "Social network analysis of COVID-19 transmission in Karnataka, India," *Epidemiology and Infection*, vol. 148, Sep. 2020, doi: 10.1017/S095026882000223X.
- [18] A. N. Wickramasinghe and S. Muthukumarana, "Social network analysis and community detection on spread of COVID-19," *Model Assisted Statistics and Applications*, vol. 16, no. 1, pp. 37–52, Mar. 2021, doi: 10.3233/MAS-210513.
- [19] M. Ostovari, C. Jurkovic, L. Pachter, and D. Chen, "A social network analysis approach for contact tracing in the hospital setting," *Delaware Journal of Public Health*, vol. 6, no. 3, pp. 22–25, Aug. 2020, doi: 10.32481/djph.2020.08.007.
- [20] K. Nagarajan, M. Muniyandi, B. Palani, and S. Sellappan, "Social network analysis methods for exploring SARS-CoV-2 contact tracing data," *BMC Medical Research Methodology*, vol. 20, no. 1, Dec. 2020, doi: 10.1186/s12874-020-01119-3.
- [21] H. Jin, L. Lu, J. Liu, and M. Cui, "Complex emergencies of COVID-19: management and experience in Zhuhai, China," *International Journal of Antimicrobial Agents*, vol. 55, no. 5, May 2020, doi: 10.1016/j.ijantimicag.2020.105961.
- [22] S. Baggechi, "Stigma during the COVID-19 pandemic," *The Lancet Infectious Diseases*, vol. 20, no. 7, Jul. 2020, doi: 10.1016/S1473-3099(20)30498-9.
- [23] "Press Statement: UNAIDS condemns misuse and abuse of emergency powers to target marginalized and vulnerable populations," UNAIDS. Accessed: Oct. 19, 2021. [Online]. Available: [https://www.unaids.org/en/resources/presscentre/pressreleaseandstatementarchive/2020/april/20200409\\_laws-covid19](https://www.unaids.org/en/resources/presscentre/pressreleaseandstatementarchive/2020/april/20200409_laws-covid19).
- [24] C.-C. Chew, X.-J. Lim, C.-T. Chang, P. Rajan, N. Nasir, and W.-Y. Low, "Experiences of social stigma among patients tested positive for COVID-19 and their family members: a qualitative study," *BMC Public Health*, vol. 21, no. 1, Dec. 2021, doi: 10.1186/s12889-021-11679-8.
- [25] S. Jayakody *et al.*, "'Why are you not dead yet?': dimensions and the main driving forces of stigma and discrimination among COVID-19 patients in Sri Lanka," *Public Health*, vol. 199, pp. 10–16, Oct. 2021, doi: 10.1016/j.puhe.2021.07.001.
- [26] Y. Yuan *et al.*, "COVID-19-related stigma and its sociodemographic correlates: a comparative study," *Globalization and Health*, vol. 17, no. 1, Dec. 2021, doi: 10.1186/s12992-021-00705-4.
- [27] T.-M. Zhang, Q. Fang, H. Yao, and M.-S. Ran, "Public stigma of COVID-19 and its correlates in the general population of China," *International Journal of Environmental Research and Public Health*, vol. 18, no. 21, Nov. 2021, doi: 10.3390/ijerph182111718.
- [28] A. Yang *et al.*, "Who says what in which networks: What influences social media users' emotional reactions to the COVID-19 Vaccine Infodemic?," *Social Science Computer Review*, vol. 41, no. 6, pp. 1986–2009, Dec. 2023, doi: 10.1177/08944393221128940.
- [29] C. Haddad *et al.*, "Stigma toward people with COVID-19 among the Lebanese population: a cross-sectional study of correlates and mediating effects," *BMC Psychology*, vol. 9, no. 1, Oct. 2021, doi: 10.1186/s40359-021-00646-y.
- [30] A. C. Tricco *et al.*, "PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation," *Annals of Internal Medicine*, vol. 169, no. 7, pp. 467–473, Oct. 2018, doi: 10.7326/M18-0850.
- [31] J. Popay *et al.*, "Guidance on the conduct of narrative synthesis in systematic reviews," *ESRC Methods Programme*, 2007.
- [32] H. Arksey and L. O'Malley, "Scoping studies: towards a methodological framework," *International Journal of Social Research Methodology*, vol. 8, no. 1, pp. 19–32, Feb. 2005, doi: 10.1080/1364557032000119616.
- [33] Z. Munn, M. Peters, C. Stern, C. Tufanaru, A. McArthur, and E. Aromataris, "Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach," *BMC Medical Research Methodology*, vol. 18, no. 143, pp. 1–7, 2018.
- [34] M. D. J. Peters, C. M. Godfrey, H. Khalil, P. McInerney, D. Parker, and C. B. Soares, "Guidance for conducting systematic scoping reviews," *International Journal of Evidence-Based Healthcare*, vol. 13, no. 3, pp. 141–146, Sep. 2015, doi: 10.1097/XEB.0000000000000050.
- [35] R. A. Smith and M. Baker, "At the edge? HIV stigma and centrality in a community's social network in Namibia," *AIDS and Behavior*, vol. 16, no. 3, pp. 525–534, Apr. 2012, doi: 10.1007/s10461-012-0154-9.
- [36] L. M. Bogart *et al.*, "A pilot test of Game Changers, a social network intervention to empower people with HIV to be prevention advocates in Uganda," *AIDS and Behavior*, vol. 24, no. 9, pp. 2490–2508, Sep. 2020, doi: 10.1007/s10461-020-02806-4.
- [37] J. Ramirez-Valles, S. Fergus, C. A. Reisen, P. J. Poppen, and M. C. Zea, "Confronting STIGMA: Community involvement and psychological well-being among HIV-Positive Latino Gay Men," *Hispanic Journal of Behavioral Sciences*, vol. 27, no. 1, pp. 101–119, Feb. 2005, doi: 10.1177/0739986304270232.
- [38] A. C. Tsai *et al.*, "Stigma as a fundamental hindrance to the United States opioid overdose crisis response," *PLOS Medicine*, vol. 16, no. 11, Nov. 2019, doi: 10.1371/journal.pmed.1002969.
- [39] A. J. M. Dijker and W. Koomen, *Stigmatization, tolerance and repair*. Cambridge University Press, 2007, doi: 10.1017/CBO9780511489815.
- [40] W. Kollmann, M. Amering, B. Schrank, and I. Sibitz, "The role of stigma resistance in persons with schizophrenia and schizoaffective disorder," *European Psychiatry*, vol. 26, no. S2, pp. 1420–1420, Mar. 2011, doi: 10.1016/S0924-9338(11)73125-X.
- [41] C. Campbell, Y. Nair, and S. Maimane, "Building contexts that support effective community responses to HIV/AIDS: a South African case study," *American Journal of Community Psychology*, vol. 39, no. 3–4, pp. 347–363, Jun. 2007, doi: 10.1007/s10464-007-9116-1.






- [42] D. Harff, C. Bollen, and D. Schmuck, "Responses to social media influencers' misinformation about COVID-19: A pre-registered multiple-exposure experiment," *Media Psychology*, vol. 25, no. 6, pp. 831–850, Nov. 2022, doi: 10.1080/15213269.2022.2080711.
- [43] E. Pöyry, H. Reinikainen, and V. Luoma-Aho, "The role of social media influencers in public health communication: Case COVID-19 pandemic," *International Journal of Strategic Communication*, vol. 16, no. 3, pp. 469–484, May 2022, doi: 10.1080/1553118X.2022.2042694.
- [44] J. Hou and M. Park, "Dissemination of information on stigmatized and risky health behaviors on social media," in *Social Web and Health Research*, Cham: Springer International Publishing, 2019, pp. 123–138, doi: 10.1007/978-3-030-14714-3\_7.
- [45] J. G. Anderson, "Evaluation in health informatics: social network analysis," *Computers in Biology and Medicine*, vol. 32, no. 3, pp. 179–193, May 2002, doi: 10.1016/S0010-4825(02)00014-8.
- [46] P. Dolan and M. M. Galizzi, "Like ripples on a pond: Behavioral spillovers and their implications for research and policy," *Journal of Economic Psychology*, vol. 47, pp. 1–16, Apr. 2015, doi: 10.1016/j.joep.2014.12.003.
- [47] H. Luo and Y. Ren, "Analysis of COVID-19 collective irrationalities based on epidemic psychology," *Frontiers in Psychology*, vol. 13, Mar. 2022, doi: 10.3389/fpsyg.2022.825452.
- [48] P. Kumar and A. Sinha, "Information diffusion modeling and analysis for socially interacting networks," *Social Network Analysis and Mining*, vol. 11, no. 1, Dec. 2021, doi: 10.1007/s13278-020-00719-7.
- [49] S.-F. Tsao, H. Chen, T. Tisseverasinghe, Y. Yang, L. Li, and Z. A. Butt, "What social media told us in the time of COVID-19: a scoping review," *The Lancet Digital Health*, vol. 3, no. 3, pp. 175–194, Mar. 2021, doi: 10.1016/S2589-7500(20)30315-0.
- [50] A. Anwar, M. Malik, V. Raees, and A. Anwar, "Role of mass media and public health communications in the COVID-19 pandemic," *Cureus*, Sep. 2020, doi: 10.7759/cureus.10453.
- [51] R. A. Smith *et al.*, "Longitudinal study of an emerging COVID-19 stigma: Media exposure, danger appraisal, and stress," *Stigma and Health*, vol. 8, no. 1, pp. 12–20, Feb. 2023, doi: 10.1037/sah0000359.

## BIOGRAPHIES OF AUTHORS






**Izyan Hazwani Baharuddin**    is a lecturer pursuing a Ph.D. in Medicine at Universiti Teknologi MARA. With a background in Biomedical Science and an MSc in Medical Statistics, she fueled her expertise in areas such as medical statistics, research design, dentistry and questionnaire design. Her ongoing Ph.D. research focuses on characterizing COVID-19 stigma in using social network analysis. Beyond academia, she actively contributes as a reviewer for various journals. She can be contacted at email: izyan9192@uitm.edu.my.






**Nurhuda Ismail**    is a Public Health Medicine Specialist with expertise in epidemiology of communicable diseases, infectious disease modeling, and intervention management. Holding an MD from UKM (2002), an MPH from the University of Malaya (2008), and a DrPH from the University of Malaya (2017), she is currently a Coordinator for the Doctor of Public Health (DrPH) Program and a Medical Lecturer at the Faculty of Medicine, Universiti Teknologi MARA. A founding member of the Research Group Infectious Disease (RG-ID), she actively contributes to the academic and research landscape. Her extensive involvement in specialized training, memberships in prestigious organizations, and numerous research projects underscore her commitment to advancing public health. With a strong track record in supervising postgraduate students and securing research funding, she continues to make significant contributions to the field, addressing critical issues such as infectious disease prevention, workplace health, and tuberculosis management. She can be contacted at email: yuda@uitm.edu.my.






**Megan S. Patterson**    is an Assistant Professor in the Department of Health Behavior at Texas A&M University. Her research focuses on how social connections, positions, and networks impact the health and well-being of individuals and communities. As such, most of her research uses social network analysis (SNA) as a methodology and theoretical framework to determine the importance of social networks and social network properties relative to health and behavioral outcomes. Patterson received her BA in Psychology and MPH in Community Health from Baylor University, and earned her Ph.D. in Health Education from Texas A&M University (TAMU). Before becoming a professor at TAMU, Dr. Patterson served as the Director of Wellness at Baylor University from 2013 until 2018. She can be contacted at email: megpatterson@tamu.edu.






**Siti Munira Yasin**    is an Associate Professor and Head of Occupational Health Unit at Hospital UiTM. She holds a Medical Degree from the University of Ireland, Galway, a Masters in Public Health from the University of Malaya, and a Doctorate in Public Health from the University of Malaya, specializing in smoking cessation at the workplace. She is a registered Occupational Health Doctor and a certified Chemical Health Risk Assessor. She has contributed significantly to research, publications, and has received numerous awards for her excellence and innovation in occupational health. She can be contacted at email: smunira@uitm.edu.my.



**Nyi Nyi Naing**    is a Full Professor in Medical Statistics at the Faculty of Medicine, Kampus Gong Badak, Universiti Sultan Zainal Abidin. Joining UniSZA in 2017, his academic journey began in 1986 with a Bachelor of Medicine and Bachelor of Surgery from the Medical Institute Rangoon, Burma. He earned a Master of Public Health and a Diploma in Tropical Medicine and Hygiene from Mahidol University, followed by a Master of Medical Statistics from Newcastle University in 2001. With an extensive publication record in reputable international journals, he has established himself as a leading authority in his field. He can be contacted at email: syedhatim@unisza.edu.my.



**Khalid Ibrahim**    is a distinguished medical professional with experience in healthcare administration and public service. With a robust academic background, including an M.Sc. in Hospital and Health Service Management from the University of South Bank, London, and an MBBS from Universiti Malaya, he has been a trailblazer in various healthcare roles. His extensive service spans directorial positions in hospitals, contributing significantly to clinical governance and patient safety initiatives. Beyond his professional achievements, he is a dedicated contributor to society, having chaired various organizations and played pivotal roles in humanitarian missions. His numerous awards reflect his commitment to excellence in the medical field and beyond. He can be contacted at email: drkhalid@uitm.edu.my.