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Editorial Article

Systematizing The Transmission of Infectious Diseases in Families

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Abstract

The transmission of infectious diseases within families is highly efficient due to prolonged physical contact, shared living spaces, and frequent interaction with common surfaces.

In this scenario it is crucial to systematize the transmission of infectious diseases within families: 1) to protect the most vulnerable (children, the elderly, and people with weakened immune systems who are more susceptible); 2) break chains of transmission (by understanding how diseases are transmitted—airborne, through contact, etc.—actions such as handwashing, masks, and physical distancing can be implemented to stop the spread within the home and to the community); 3) establish healthy habits (the family is the primary learning environment for habits such as hygiene, covering one's mouth and nose when sneezing, etc., which are fundamental for long-term prevention); 4) reduce the burden of disease (fewer infections mean less absenteeism, lower expenses, and better overall well-being for all family members); and 5) prevent community outbreaks (knowledge of transmissibility allows for a rapid response such as quarantine, isolation, and treatment) and prevents a mild infection from becoming severe or turning into an epidemic.

Keywords: Health model: Family health; Epidemiology; Disease transmission; Family transmission

Introduction

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However, there is a conceptual and methodological gap in the family health approach that hinders the systematization of transmission of infectious (and non-infectious) diseases in families and hinders comprehensiveness in health practice.

Common transmission chains within families can be categorized as follows:
1) Direct contact: kissing, hugging, skin-to-skin contact; 2) Droplet/Airborne transmission: coughing, sneezing, or even breathing releases droplets that infect others. Respiratory illnesses are transmitted this way: colds, flu, COVID-19, and RSV are spread through respiratory droplets and aerosols; 3) Indirect contact (fomites): touching surfaces (doorknobs, toys, phones) contaminated with germs and then touching the eyes, nose, or mouth. Some bacterial infections are transmitted this way: staphylococcus can be spread through contact with contaminated skin or items; 4) Fecal-oral: Transfer of germs from feces or vomit to the mouth via contaminated hands, food, water, or surfaces. Gastrointestinal diseases are transmitted in this way: norovirus, E. coli, and hepatitis A are transmitted via the fecal-oral route; and 5) Bloodborne transmission: Contact with infected blood or bodily fluids (e.g., hepatitis B, HIV), although this is less common in daily family life unless needles are shared or serious wounds are treated.

A model is a conceptual framework that is useful for specifying and interpreting the diverse information that can be obtained within any field of inquiry in which phenomena are to be analyzed. A model reduces the previously unconnected information about the object of study and acts as a mediator between the researcher and the theory itself, while also guiding their path toward the analysis of reality (1).

The systematization of disease transmission models in families can be carried out by integrating biological, social, and systemic approaches, which view the family as an interactive unit. Different methodologies can be used to structure these models. The main ones are:

1. Biological and infectious transmission models. Compartmental models are used, such as the SIR model (2: Susceptible, Infected, Recovered) to mathematically represent the flow of disease between members according to contact rates and latency periods. The SIR model is a mathematical approach to the spread of infections.

On the other hand, there is the Multigenerational Transmission model based on Bowen's Family Systems Theory; this model systematizes how emotional patterns, health behaviors, and genetic predispositions are transmitted across generations. A good analogy for this system is to think of the family as a plant and the people who make up that family as the leaves of that plant; If a botanist examines a plant and sees that one of its leaves is drying out, they don't remove that leaf to take it to a clinic for a series of tests to discover the cause of the problem. Instead, they examine the entire plant and its surrounding environment (3).

2. Visual Systematization Tools. To organize complex family information, standardized instruments such as the genogram are used to map relational and hereditary patterns (4-10). The genogram is a visual tool that traces family history across generations to identify recurring patterns of illness, roles, and alliances. The graphic representation allows for the identification of disease patterns, causes of death, and conflictive relationships in at least three generations.

Another visual systematization tool is the ecomap. This tool systematizes the family's relationship with external systems (health, work, community) that can influence the risk of transmission. Unlike the genogram—which represents the internal structure and family relationships—the ecomap focuses on external connections, highlighting aspects such as the strength of the bond, support flows, and the quality of those relationships, in order to understand the quality of the networks surrounding a person or family group (11-14).

Finally, another useful tool is the Family APGAR: It evaluates the functionality of the family system, a key factor in treatment adherence and the management of diseases (15).
3. Systemic and Life Cycle Approach (16, 17): This approach includes the Family Health Model, which is structured in dimensions (context, composition, relationships, coping) for a comprehensive view, integrating the biological, social, and psychological aspects. This model provides an integrative view of the social and psychological processes involved in the health of the family group, derived from the systems approach, life cycle theory, and family stress—foundations that are integrated into a holistic and dialectical worldview. This fosters an understanding of the family-health relationship while consolidating the practical application of the biopsychosocial paradigm (18).
The Family Health Model views the family as the core unit for health-disease processes, recognizing it as a primary setting for infectious disease transmission, risk development, and health behavior formation, impacting prevention, spread within households), and recovery through shared dynamics, structures (such as age/size), and processes (such as conflict/support).
The key aspects of Family Health Models in relation to infectious Disease are: 1) Household as a Transmission Hub: For many infections, strong contact within the home (household) makes it a major site for transmission, affecting family members more intensely than the wider community; 2) Risk and protective factors: Family dynamics (communication, conflict, supervision), socioeconomic status, and even cultural attitudes influence susceptibility and response to infections; 3) Behavioral Influence: Family units develop, maintain, and change health behaviors (handwashing, masking, vaccination) crucial for preventing infectious disease spread; And 4) Health-Illness Cycle describes family phases during illness (vulnerability, acute response, adaptation), showing how the family unit responds collectively to disease onset, influencing recovery and prevention of relapse (19).
Likewise, within the Systemic and Life Cycle Approach, there is the Family Health-Illness Cycle Model: it describes phases families experience with illness (promotion, vulnerability, onset, response, adaptation), offering frameworks to understand family dynamics in infectious disease models focus on the pathogen's journey (agent, host, transmission, environment) and epidemiological patterns. These intertwine as infectious outbreaks strain family coping, requiring models to integrate individual susceptibility (genetics, behavior) and systemic responses (social, cultural), highlighting

how family strengths and vulnerabilities influence disease spread and recovery, from initial exposure to long-term adaptation (19-21).

Finally, also within the Systemic and Life Cycle Approach, the Systemic Intervention model can be cited, which considers the family as a unit where a change in one member affects the entire system. It focuses on roles, hierarchies, and internal communication to understand how the impact of a pathology spreads (22).

4. Systematization Criteria (Bradford-Hill Model). These are nine criteria to assess whether an observed association, such as an infectious agent in a family, implies causation, not just correlation. In the context of infectious disease transmission within families, these criteria help researchers distinguish between mere correlation (e.g., family members sharing the same environment) and actual transmission from one person to another. In disease transmission, they help epidemiologists link exposure to outcome by looking for strong, consistent patterns, exposure before the disease, dose-response, biological sense, and supporting evidence, though not all criteria must be met for a causal conclusion, especially in complex family settings. By applying these criteria, researchers move beyond "family members got sick after living together" to "this specific infection caused illness in the family," informing public health measures like isolation.Temporality: This is the most critical criterion. The "primary case" must show symptoms or test positive before the "secondary case" to establish a transmission direction.

The Bradford Hill criteria applied to Family Transmission are: Strength of Association: A high Secondary Attack Rate within households (compared to the general community) suggests a strong causal link for family transmission; Consistency: The same transmission patterns (e.g., children frequently infecting parents) should be observed across different families and geographical locations; Biological Gradient (Dose-Response): Transmission risk may increase with the "dose" of exposure, such as physical proximity or duration of contact between family members; Plausibility and Coherence: The transmission must align with known biological mechanisms (e.g., respiratory droplets for influenza) and the natural history of the pathogen; Specificity: If a specific strain of a pathogen is found only in one family cluster and not in others, it provides strong evidence for internal family transmission; Analogy: If a new virus behaves similarly to a known virus (e.g., SARS-CoV-2 behaving like SARS-CoV-1), family transmission is more easily inferred; Experiment: While rare in human families, "natural experiments" (e.g., household quarantine measures that successfully stop spread) can provide evidence of causation (23-28).

In summary, due to the high frequency, long duration, and intimacy of contacts within the home, household transmission constitutes a substantial risk factor in the dynamics of infectious diseases. Furthermore, households often contain people from different generations (e.g., parents and children) who belong to different subpopulations outside the home, which can facilitate the spread of an infection from schools to workplaces. However, a conceptual and methodological gap exists in the family health approach. Modeling the dynamics of infectious disease transmission within the family is of great interest for estimating epidemiological parameters and helping to understand transmission pathways as well as the effects of preventive and therapeutic interventions.

References:

1. Alonso M G, Martín CB (1996). [Theoretical model for cultural identity]. Centro de Investigación y Desarrollo de la Cultura Cubana Juan Marinello. https://catalogue.leidenuniv.nl/discovery/fulldisplay/alma990031422410302711/31UKB_LEU:UBL_V1
2. Suvarna T. The SIR Model. Modelling COVID-19. Scott E Page & MO 410 Students UM-Ross. 2020; Mar 25. https://sites.google.com/umich.edu/manymodelsclovid19/home/the-models-of-covid-19/sir-model?authuser=0
3. Cruzat Olavarrieta A. [Murray Bowen's natural systems theory: a new understanding of health/disease processes in families and organizations]. Medware. 2007. http://doi.org/10.5867/medwave.2007.10.934
4. Turabian JL. A Biopsychosocial Instrument to Study and Intervene in the Complexity of Changes and Stability of Family and Community System Health: The Genogram. Arch Health Sci 2023; 7(1): 1-8. https://gudapuris.com/articles/10.31829-2641-7456-ahs2023-7(1)-014.pdf
5. Turabian JL. Family Genogram in General Medicine: A Soft Technology that can be Strong. An Update. Res Med Eng Sci. 2017; 3(1). http://crimsonpublishers.com/rmes/pdf/RMES.000551.pdf
6. Russell LT. Capturing Family Complexity in Family Nursing Research and Practice. J Fam Nurs. 2020; 26(4):287-93. https://journals.sagepub.com/doi/full/10.1177/1074840720965396
7. Watts C, Shrader E. How to do (or not to do)… The genogram: a new research tool to document patterns of decision-making, conflict and vulnerability within households. Health Policy Plan. 1998; 13: 459-64. https://academic.oup.com/heapol/article/13/4/459/596227
8. McIlvain H, Crabtree B, Medder J, et al.. Using practice genograms to understand and describe practice configurations. Fam Med. 1998; 30: 490-6. https://pubmed.ncbi.nlm.nih.gov/9669161/
9. Turabian JL. Storytelling, biography, and genograms. BMJ. 2025; 390: r1771. http://bmj.com/cgi/content/full/bmj.r1771?ijkey=yyPFoEZLkeWh8Ql&keytype=ref
10. Cuartas Arias JM. Genogram: tool for exploring and improving biomedical and psychological research. Int J Psychol Res (Medellin). 2017;10(2):6-7. https://pmc.ncbi.nlm.nih.gov/articles/PMC7110157/
11. Carmona L. [Family ecomap: what it is, what it's for and how to make one]. Escuela de Psicología Organizacional. 2025; 04-28. https://adipa.cl/noticias/ecomapa-familiar-que-es-para-que-sirve-y-como-hacerlo/
12. Jenson K, Cornelson BM. Eco-maps: a systems tool for family physicians. Can Fam Physician. 1987;33:172-7. https://pubmed.ncbi.nlm.nih.gov/21267351/
13. Rempel GR, Neufeld A, Kushner KE. Interactive use of genograms and ecomaps in family caregiving research. J Fam Nurs. 2007;13(4):403-19.

https://pubmed.ncbi.nlm.nih.gov/18180467/
14. Saragosa M, Singh Hardeep, Steele Gray C, Tang, et al. Exploring the Landscape of Eco-Mapping in Health Services Research: A Comprehensive Review. Health Soc Care Community. 2024; 9503785. https://doi.org/10.1155/2024/9503785
15. Ayisi-Boateng NK, Enimil A, Essuman A, et al. Family APGAR and treatment outcomes among HIV patients at two ART Centres in Kumasi, Ghana. Ghana Med J. 2022;56(3):160-168. https://pmc.ncbi.nlm.nih.gov/articles/PMC10336640/
16. Turabián JL, Báez-Montiel B and Gutiérrez-Islas E. Type of Presentation of Coronary Artery Disease According the Family Life Cycle. SM J Community Med. 2016; 2(2): 1019. https://www.researchgate.net/publication/313968447_Type_of_Presentation_of_Coronary_Artery_Disease_According_the_Family_Life_Cycle
17. Turabian JL. A Fundamental Tool of The General Doctor: Knowledge of The Family Life Cycle. J. General Medicine and Clinical Practice. 2024; 7(19). https://www.auctoresonline.org/uploads/articles/1733225561JGMCP-24-SC-240-Galley_Proof.pdf
18. Louro Bernal I. [Model of family group health]. Rev Cubana Salud Pública. 2005; 31(4). http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-34662005000400011&lng=es
19. Feinberg M, Hotez E, Roy K, et al. Family Health Development: A Theoretical Framework. Pediatrics. 2022;149(Suppl 5):e2021053509I. https://pmc.ncbi.nlm.nih.gov/articles/PMC9847418/#:~:text=Practical%20Benefits%20of%20the%20FHD,increased%20family%20violence%20(behaviors).
20. Doherty WJ. Family Theory and Family Health Research: Understanding the family health and illness cycle. Can Fam Physician. 1991;37:2423-8. https://pmc.ncbi.nlm.nih.gov/articles/PMC2145521/
21. Rolland JS. Chapter 15. Families, Health, and IllnessHandbook of Health Social Work, Third Edition. Book Editor(s):Sarah Gehlert, Teri Browne, First published: 02 August 2019. Wiley Online Library. https://doi.org/10.1002/9781119420743.ch15
22. Eckhardt M, Hultquist JF, Kaake RM, Hüttenhain R, Krogan NJ. A systems approach to infectious disease. Nat Rev Genet. 2020;21(6):339-354. https://pmc.ncbi.nlm.nih.gov/articles/PMC7839161/
23. Jefferson T, Heneghan CJ, Spencer E, et al. A Hierarchical Framework for Assessing Transmission Causality of Respiratory Viruses. Viruses. 2022;14(8):1605. https://pmc.ncbi.nlm.nih.gov/articles/PMC9332164/#:~:text=Evidence%20that%20follows%20Bradford%20Hill's,global%20economic%20and%20social%20demise.
24. Glass TA, Goodman SN, Hernán MA, Samet JM. Causal inference in public health. Annu Rev Public Health. 2013;34:61-75. https://pmc.ncbi.nlm.nih.gov/articles/PMC4079266/
25. Turabian JL. Sars-Cov-2 Transmission in Family: Study of 18 Families and 51 People without Asymptomatic Secondary Cases in a General Medicine Clinic of Toledo (Spain). Social Factors Lose Importance in Families without Asymptomatic Cases. Epidemol Int J. 2021; 5(3): 000196. https://medwinpublishers.com/EIJ/sars-cov-2-transmission-in-family-study-of-18-families-and-51-people-without-asymptomatic-secondary-cases-in-a-general-medicine-clinic-of-toledo-spain-social-factors-lose-importance-in-families-without-asymptomatic-cases.pdf
26. Turabian JL. Family Secondary Cases from Covid-19 Breakthrough Infections in Vaccinated People. International Research in Medical and Health Sciences. 2022; 5(1): 1-16. https://irmhs.com/index.php/irmhs/article/view/93/75
27. Turabian JL. Transmissibility of Primary Cases Not Completely Vaccinated and Effectiveness of Incomplete Vaccination Against Sars-Cov-2 in Secondary Cases in The Household. Study of 12 Families from February 1 to November 30, 2021 (Before Omicron), in A General Medicine Office in Toledo, Spain: It Is a Very Bad Idea Not to Complete Vaccination. Annal of Pub Health & Epidemiol. 2022; 1(5). https://irispublishers.com/aphe/pdf/APHE.MS.ID.000523.pdf
28. Turabian JL. Secondary infections in the family from primary cases of covid-19 breakthrough infections in fully vaccinated or not fully vaccinated people. two doses modestly reduce family transmission but does not eliminate it. Journal of SARS-CoV-2 Research. 2022; 2, 12 - 24. https://doi.org/10.36013/sarc-cov-2.v2i.85.