A Family Epidemiological Model: A Practice and Research Concept for Family Medicine

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Drawing on knowledge from various behavioral science disciplines and epidemiology, a conceptual model for use in practice, education, and research in family medicine has been developed. This model uses three overlapping circles of a Venn diagram to represent the host (family system), the environmental, and the agent (stressor) systems. The central overlapping area of the three circles is the "resultant adjustment" of all the multiple interacting variables, and reflects the current state of the family. This concept has been designated the Family Epidemiological Model and is an interactive, multisystem, multivariate model. Some of the educational and practical implications of its comprehensive and exhaustive approach are discussed.

The first decade (1969-1979) of the remarkable renaissance of family medicine in the United States was, according to Stephens,[1] devoted largely to political and organizational battles. Even though these are still in progress, the emphasis has now shifted to the academic sphere.[2-5] One of the major items now is the integration of the family into the discipline[6] and into the everyday practice, education, and research in family medicine. To do this, the discipline must develop its own model because models of other disciplines are not sufficiently integrative, comprehensive, and specific to meet the needs of family medicine.

This paper presents a *family* model applicable to family medicine. It has been called the Family Epidemiological Model because it utilizes epidemiologic principles and methods in looking at the family. In addition, epidemiology and family medicine have common interests and viewpoints. They are "con-

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Table 1. Theoretical Family Models in the Behavioral Sciences

1. Systems (structural-functional)
2. Psychoanalytic
3. Conflict
4. Symbolic interaction
5. Developmental
6. Exchange

cerned with the full spectrum of human disease and health without restriction to organ systems or pathophysiological processes,"[7] and both depend on probability decision making.[8]

In the last few decades, investigators and practitioners from various disciplines (such as sociology, psychiatry, anthropology, and social work) have assessed and treated the family using various models and techniques.[9-21] Some of the family assessment models used by the behavioral sciences are depicted in Table 1. The systems (structural-functional) model will be discussed later, while the psychoanalytic model is well known to physicians. The conflict model is related to economic and family power, ownership of the means of production, and more recently, gender role differences within the family.[22,23] Symbolic interaction emphasizes communication and the development and maintenance of relationships.[24,25] The developmental model includes the dimension of time as it relates to the changing family life cycle,[26] while the exchange model looks at the symbolic and material rewards and costs of developing continuing relationships.[27,28]

Some of these theoretical models form the basis for specific clinical approaches, eg, the systems model for the systems approach and psychoanalytic theory for the analytic, dynamic, and transgenerational methods. Certain clinical approaches such as transactional, behavioral, experiential, problem solving, and preventive are not so directly related and are used by clinicians of various "schools."

An additional dimension important in assessing the clinical utility of models is the scope of their investigation. Do they focus on the individual, the marital dyad, the nuclear or extended family, or even a wider group? Is an effort made to help the individual family through providing a supportive organization or structure as in group therapy or self-help groups?[29] If the focus is on the individual patient, can a family orientation be developed?[30]

Definitions

In discussing family epidemiology, it is useful to begin with definitions of the family and of epidemiology. The word *family* comes from the Latin "famulus" (a servant) and in early biblical times was applied to the *famalia,* or servants, as well as to the relatives of our nomadic ancestors. The structure of this basic unit of society has changed with the passage of time. There are today literally dozens of definitions of family which will not be reviewed here. A definition is needed of the family as well as the unit of care, or household, where these are not one and the same. The following definitions are used for the purpose of this discussion.

The family: Two or more people related by blood, marriage, a marriage-like relationship, or adoption

The unit of care: One person living alone or, two or more people sharing a household

In many family practices, the local family and household are synonymous and serve as the unit of care. However, in many places, eg, inner cities, college dormitories, residential homes, the household contains members of different families, so the unit of care (whether it is for infectious diseases or relationships) is the household.

Epidemiology has also been defined in many ways. The word comes from "epidemic" (meaning "on the people") and was for many years confined to the study of infectious diseases in population groups. The definition broadened as the methods of epidemiology were applied to noninfectious diseases and many other conditions and situations. It also developed its own body of knowledge as it became an academic discipline. The following definition is used here:

Epidemiology is the study of the distribution, determinants, and control of factors and processes involved in the continuum of health and disease in groups of people. Epidemiology utilizes a scientific method and accumulates a body of knowledge (definition of E. Mortimer, MD, H. Houser, MD, and J.H. Medalie, MD, 1980).

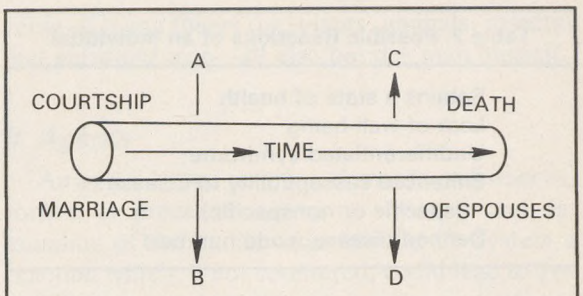

Figure 1. Family life capsule

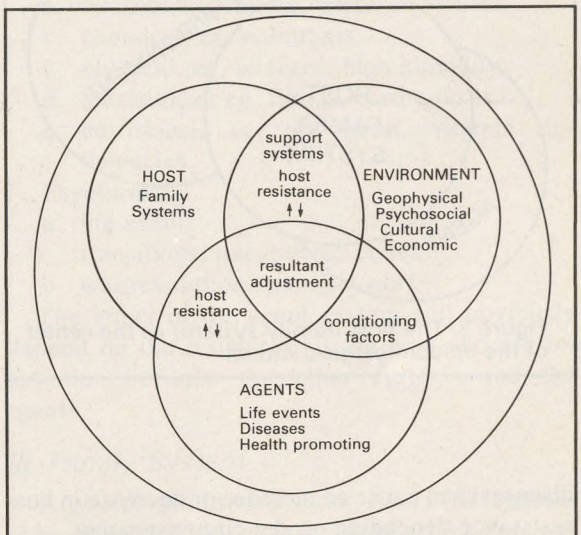

Figure 2. Family epidemiological model

The Model

The major characteristic of any family, over its life cycle, is change.[17,31] These include changes in its structure, economic base, educational standards, place of residence, recreational patterns, and satisfaction level.[26,32] While undergoing these changes, the family (with or without outside help) adjusts and adapts by altering its functions in an attempt to retain or regain its homeostasis, or equilibrium. The health status of the individual members and the family as a whole is sometimes the reflection of these changes, while at other times health status itself (eg, birth of an infant with severe congenital abnormalities) may lead to changes in the family system.

The family life cycle over time is represented diagrammatically in Figure 1 by a straight tube or capsule. A model is needed to assess the family at different time periods as represented by lines A-B or C-D. A cross-section at A-B, using a type of Venn diagram, produces three interacting and overlapping circles (Figure 2), each of which can be designated as one of the three elements of an epidemiological model. The host, for these purposes, is the family system, the environment, and the agent. When three circles of a Venn diagram overlap, there will be three areas common to two of the larger circles and one common to all three.

When the environment and the host interact, the resistance of the host can be decreased or increased. As an example, the area common to the family and the environment can be designated as support systems. This implies that the support can be part of the family system only, or can be supplied by environmental agencies alone, or as is often the case, is a combination of activities within as well as outside the family. The fundamental importance of support systems in prevention and alleviation of disease has been and is being well documented.[33-39]

The interacting environmental and agent variables result in what can be designated as conditioning factors for the host-family system. Agents or stressors such as life events (eg, marriage, death,

Table 2. Possible Reactions of an Individual

Retains a state of health
Lack of well-being
Undifferentiated syndrome
Enhanced susceptibility to disease (specific or nonspecific)
Defined disease (code number)

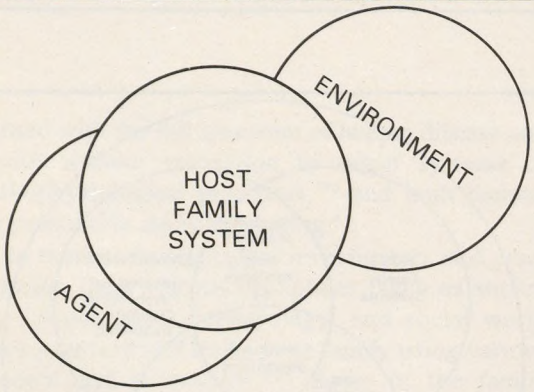

Figure 3. The host (family system) as the center of the epidemiological model

diseases) can cause an increase or decrease in host resistance depending on the circumstances.

The middle area, common to and overlapping all three larger circles, is depicted as resultant adjustment, implying that the adjustment of a family at all times is the result of multiple interacting factors. In keeping with this concept of disease etiology, Table 2 shows some of the possible reactions of an individual. These may take one of many forms. He/she may remain in, or regain, a state of health, or have a feeling of "lack of well-being." The individual might develop one of the many ill-defined symptoms of what is called the "undifferentiated syndrome," or he might have lowered resistance so that there is an enhanced susceptibility to disease. Finally, the person might develop a specific, defined disease which can be assigned a classification (ICHPCC or other) code number.

This individual reaction occurs within the framework of the family adjustment to the multiple interacting forces. Family functioning might remain in, or even improve its homeostasis, or develop a type of dysfunction ranging from mild to very severe. The latter might lead to disruption (separation or divorce) or a permanent corrosive state of disequilibrium. Within this functional adjustment, the health status of each individual and the family as a whole is affected. This might occur to all of them simultaneously (eg, an epidemic), or one or all the members might be affected in varying kinds of patterns which are only now beginning to be observed and understood (Table 3).

The position and size of the three large circles in Figure 2 imply that family, environment, and agent are of equal importance. While this is often the case, the more common situation in family medicine is that the family system is of major importance with factors from environment and agent acting as background influences on the family. This view is depicted in the positions of the circles in Figure 3 in which the family is the center of

Table 3. Family Adjustment

Function	Health Status
Homeostasis	Adjusted
Mild dysfunction	One or more members affected simultaneously, in progression, or alternately
Moderate dysfunction	
Severe dysfunction	All members affected ±specific diseases
Disruption	

attention. Further description is useful for each of the three large circles:

I. Environment

Environment comes from the French, meaning "around" and Webster's dictionary defines it as "all the conditions, circumstances, and influences surrounding and affecting the life of a person or community."[40] The categories within the environment interact with each other to form an environmental system and these subsystems can conveniently be classified as:

1. Economic—Economic status is determined by the ability to purchase goods and services. The economic factor is a vital one for each family. When it falls below a threshold or point at which the family income does not meet the needs, the effect pervades all other aspects of living and is a severe and debilitating handicap with obvious effects on morbidity and mortality.[41] Some of the health consequences of unemployment have been studied in detail.[42-44]

2. Social—Social environment includes all associations of man with man. These include the political, racial, occupational, educational, religious, recreational, and medical care systems, as well as informal social contacts. Owing to identification and empathy with their patients, family physicians often become part of the family system of the patients they treat.[45-47]

3. Cultural—Cultural environment includes the values and behavior of people of similar beliefs. There are important health differences and implications depending on whether the families belong to the majority or dominant culture, a minority one, or a marginal group.

4. Geophysical—In the time of Hippocrates, terrestrial and meteorological influences explained all the phenomena of disease, while in the Galen era, illness depended on interactions of temperament, habits of life, and conditions of the atmosphere. Today, the effect of climate, season, geographic location, geologic and soil structure, as well as the composition of air, water, and soil, have important influences on health. Some of the documented examples are: association of soft water with cardiovascular mortality; cold climate and respiratory infections; high altitudes and dyspnea; and iodine deficient soil and goiters.

5. Biologic—Biologic environment is the universe of living things (eg, plants, animals, insects) that surround man—all else besides man himself.

II. Agents

An *agent* is one or more elements, substances, forces, or processes acting as *stressors* and demanding of the human organism/family system a reaction which, if not countered, could lead to disequilibrium, maladjustment, and/or symptoms, diseases, or syndromes.

Agents or stressors can be grouped as follows:

1. Biologic
   a. microbiological, eg, bacteria, viruses
   b. chemical, eg, pollutants
   c. physical, eg, blizzard, high humidity
   d. mechanical, eg, floods, earthquakes
   e. nutritional, eg, starvation, vitamin deficiencies
2. Psychosocial
   a. life events:
      transitions, unexpected crises
   b. war/revolution/terrorism/riots

The effect of the agent system will obviously depend on the resistance of the host and the interaction between the other systems and the agents.

III. Family System

A *system* (family) is a set of units with relationships between them. These relationships are governed by certain laws:

1. The system as a whole is greater than the sum of its parts.

2. Anything which affects the system as a whole affects each individual unit within the system.

3. Any change in one unit affects all the other units individually and the system as a whole (Gooderham MEW: A systems orientation for family assessment, unpublished).

The above applies to any system, whether it is an individual cell or a complex system like a family. The family system consists of a number of subsystems like the parental coalition, the parent-child, or the sibling relationships, and may be in the form of dyads, triads, and so on. In addition, the family, like any system, is surrounded by a membrane or boundary which may be open, semipermeable, or relatively closed and impermeable (eg, a minority family which finds itself or

Table 4. Family Categories Schema[49]

1. **Problem Solving**
   - A. Instrumental
   - B. Affective
2. **Affective Expression and Involvement**
   - A. Welfare emotions—eg, happiness
   - B. Emergency emotions—eg, rage
3. **Communication**
   - A. Type—eg, affective, instrumental
   - B. Patterns—eg, clear, masked
4. **Role Behavior**
   - A. Traditional roles—eg, mother, child
   - B. Idiosyncratic roles—eg, scapegoat
5. **Autonomy**
   - A. Capacity for independent action
   - B. Ability to make responsible choices
6. **Modes of Behavioral Control**
   eg, Rigid, flexible, chaotic

Table 5. Minuchin's Family Therapy Model[19]

1. Family structure/function
2. Family development
3. Family adaptation

keeps itself isolated from its neighbors who all belong to a different culture).

Other Models

The models used by behavioral scientists to study families usually result in long questionnaires or observational protocols covering numerous variables and parameters. They are time consuming and not attractive to practicing family physicians. Teachers and practitioners in family medicine are naturally looking for reliable, short assessment methods (which often come with experience). It is important to realize, however, that in training family practice residents and students for practice and research, it may be necessary to go through the long route in order to determine relevant and valid short approaches. Therefore, it is useful to examine and extract from the methods of other disciplines those parts that are relevant to family medicine in order to go beyond the description of patients and their families as described by Richardson in the 1950s.[48]

A number of departments of family medicine have attempted to extract important material from other disciplines and apply it to family practice.

At McMaster University School of Medicine in Canada, the Departments of Psychiatry and Family Medicine collaborated in a pioneering program designed to teach "the understanding and managing of psychosocial problems encountered in family practice based upon the family system model."[49] This collaboration produced the Family Categories Schema (Table 4) which covers the areas of family functioning and capacity.

This approach seems to be working well and the authors state that they have found "that the integration of the family therapy approach in daily practice has proven to be practical and helpful in understanding the behavior of family members, and in helping families to function more effectively."[50]

Some departments of family medicine base their approach on the well-documented principles of structural family therapy used by Minuchin and his colleagues in Philadelphia, which is based on three major areas of information (Table 5).[19]

This approach, when used by well-trained individuals, produces very good results with satisfied families and residents.

A third approach was elaborated by Reuben Hill, one of the pioneers of sociology of the family[51,52] and a leading figure, along with Duvall, in conceptualizing the family development-life cycle approach. It was proposed and developed by Karl Tomm as a Family Assessment Model based on family system theory (Table 6).[53] It is a guide for the systematic organization of data.

This approach emphasizes a developmental assessment using the family life cycle and puts together a family problem list from the three assessment areas. Examples of this kind of problem list are:

From the structural area:
multiple geographic moves (highly mobile)
multiple agency involvement
isolated family
From the functional area:
relative absence of father due to work involvement
persistent scapegoating pattern
husband-wife role reversal

From the developmental area:
pregnancy with no male identified
unresolved loss of father
distorted mother-child attachment

This model, in many ways, is closer to the model needed in family practice, except that the problem list relates to emotional and social aspects only.

A fourth example is one developed by Smilkstein.[54,55] He not only developed a Family Problem-Oriented Model (Table 7), but also tested the "functional" part of it for validity[56] against both a family function index of Pless and Satterwhite[57] and a score by clinical therapists.

In 1977, Medalie presented a scheme for Family Diagnosis (Table 8) at John Cassel's Memorial Symposium in Chapel Hill, North Carolina.[58] Table 8 is a slightly modified version that incorporates the major areas of all the above schemes in a way which is relevant to family practice.

This scheme attempts to include all the major categories of the previous models, ie, the problems, the structural, functional, and developmental assessments (together with the health status of the members), to produce an integrated diagnostic and management plan.

Table 6. Family Assessment Model (Tomm)[53]

1. **Structural Assessment**
   A. External
   B. Internal
2. **Functional Assessment**
   A. Instrumental
   B. Expressive
   (this is a modification of Epstein et al's Categories Schema
3. **Developmental Assessment**
   A. Family life cycle
   B. History of specific problems
4. **Family Problem List** (from sections 1, 2, and 3)

Table 7. Family Problem-Oriented Model[54,55]

1. Data Base
   A. Crisis Episode (presenting problems)
   B. Family Resources (SCEEM):
   Social
   Cultural
   Economic
   Educational
   Medical
   C. Functional Status (APGAR):
   Adaptation—resources available for coping
   Partnership—problem sharing
   Growth—acceptance of change
   Affection—expression of affection and response to feelings
   Resolve—time spent with family
2. Problem List from 1A, 1B, and 1C
3. Plan
4. Follow-Up

Discussion

In the last few years, this department has not concentrated on any one model but has been teaching and using the principles and methods from a number of them, as well as different approaches to family management. Educationally, the authors believe that all relevant models should be introduced to the residents because different models might have to be used with different people and problems. The effect of using multiple models has been a marked improvement in the understanding of attitudes towards and management of families, as well as a noticeable movement towards putting the family into the center of everyday clinical practice. The department is also beginning to integrate it into research thinking and planning.

Having examined the three large circles (host, environment, and agent) of the Family Epidemiological Model, it is clear that each circle can be regarded as a type of system with the units and subunits being interdependent and interacting. Each system has within it many variables and parameters so that the Family Epidemiological Model can be summarized as an interactive, multisystem, multivariate model. This family approach is a framework or conceptual model for thinking, organizing the data, and planning research coverage of families.

In a way, it is the equivalent of the exhaustive approach taught to medical students upon entering their initial clerkship. In this, the student is expected to cover all aspects of the history and re-

Table 8. Guide to Family Diagnosis and Management[58]

1. **Identified Patient/Family:** Specific problems
2. **Family History and Data Base**
   - A. Family demography and household structure (family tree, plan of house, and household census, which includes education, race, religion, and economic factors)
   - B. Family history, lifeline,[59] development/life cycle
3. **Health Status or Problem List** of each individual and the family as a whole
4. **Functioning**
   - A. Internal functioning, beliefs, and interaction
   - B. External adaptation to environmental factors
   - C. Stability, supports, strengths, and adaptability (coping)
5. **Integrated Assessment** of patient and/or family
6. **Integrated Management Plan**
7. **Periodic Review and Update**

view of organ systems and to examine the patient from head to toe. In other words, he exhausts all the possibilities, as well as probably exhausting the patient, him/herself, and the attendant! Gradually, the student is expected to reduce the whole procedure by utilizing clusters of clues, or key clues, to make a provisional diagnosis or hypothesis and by a branching technique and feedback to prove or disprove the diagnosis or hypothesis.[60] Similarly, in family work, the exhaustive or modified comprehensive approach should probably be used in training of senior medical students and beginning residents (interns), while the junior and senior residents should become adept at utilizing clusters and/or key clues to hone down their diagnostic coverage from the presenting problem.[58] Correspondingly, in research work, this exhaustive approach is known as a "fishing expedition" when one tries to go for all the variables because there is no hypothesis. In these instances, only a fraction of the information collected is ever analyzed, leaving the investigator with both guilty and frustrated feelings. Instead of a fishing expedition, most research on the family should be the result of hypotheses or ideas. The use of the Family Epidemiological Model might prevent leaving out some important associated variables from other systems or subsystems.

An example of this is the fascinating study of Neser et al which showed a relationship between indices of fragmentation of black families and stroke susceptibility.[61] Almost simultaneously, Ford, in an excellent Cleveland survey, showed similar increased cerebrovascular and cardiovascular mortality among the lower socioeconomic groups and related it to increased air pollution.[62] A glance at a model such as the one described here, might have reminded Neser to include pollution and Ford to include family disorganization.

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