Integrating Community Medicine in a Family Practice Center: An Approach to Urban Lead Toxicity

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The levels of a practice model are used to provide a practical framework for integrating community medicine into the Family Practice Center. The example of lead toxicity serves to illustrate this model. By developing the family medicine knowledge base and family practice interventions on individual, family, and community levels, true integration of community medicine in everyday family practice can be achieved.

Since their inception, family practice residencies have recognized the importance of the discipline of community medicine in the training of family physicians. The Liaison Committee for Graduate Medical Education of the American Medical Association in its requirements for family practice residencies specifies, "community medicine is one of the important components of Family Practice" and recommends that its concepts be taught in an integrated manner.[1] Yet the integration of community medicine principles into family practice training programs has proven difficult. For example, in a survey of family practice residencies, Donsky and Massad found that while 94 percent of responding programs included some elements of "community medicine," less than 40 percent incorporated "techniques for evaluating the health care needs of a community"[2] into their curriculum. The development of a practical relevant model integrating community medicine into the daily functioning of a practice center remains a major challenge for family practice education. This paper focuses on a specific health problem, the risk of lead toxicity to children living in an urban environment, to illustrate a method of integrating community medicine concepts into the education of family physicians.

The medical profession is founded on what Engel describes as "the complementarity of a need for help and a desire to provide service"[3] to a distressed individual. The academic discipline of family medicine attempts to enhance this provision of health care by considering the individual within his or her family and social context.

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Medalie has proposed a model conceptualizing family practice services.[4] In this model, assessment and intervention in a community grows from concern for individual patients and their families. Health care services provided by the family physician may include isolated intervention with an individual patient, specific work with a given family unit, or assessment and intervention in resolving a community health problem, or they may integrate facets of all of these levels. As a true generalist, the ideal family physician will use problem solving techniques encompassing this broad perspective in daily practice.

Providing a good example for this problem solving approach is the urban lead problem and its relationship to the community served by the Family Practice Center, which is located on the near west side of the Cleveland metropolitan area. Urban children in general are exposed to lead through multiple environmental sources: air, water, food, dust, soil, and paint.[5] Prime urban sources include automobile exhaust, aging and deteriorating housing containing high lead-content paint, and industrial environmental contamination. Risk of lead poisoning in children is also an age-dependent phenomenon, with younger children at higher risk. The community served by the Family Practice Center contains all the necessary sources for high environmental lead. The majority of homes are 80 to 100 years old and are in varied states of disrepair. Three major highway arteries carry daily large volumes of rush hour traffic, and a primary lead smelter is located within the community.

Methods

Data were collected from summary sheets kept by the Cleveland Poison Control Program. The summary sheets contain the numbers of children screened and their risk category and are organized by census tract. Routine screening of children is performed at 16 citywide clinics as well as by private area practitioners. The Poison Control Program provides standardized laboratory assays for lead and erythrocyte protoporphyrin (EPP) levels. Risk assessment is based on venous blood levels of lead and EPP levels and categorized according to the Centers for Disease Control lead poisoning risk classification.[6] In this risk classification, class II represents a moderate, class III a high, and class IV an urgent health risk (Table 1).

Because of changes in laboratory assay technique and screening procedure, uniform monthly data were available only for 1977-1978. The target area of the Family Practice Center includes seven social planning areas. Each planning area is composed of a cluster of six to eight census tracts. These areas were developed by the city health department in cooperation with the Federation for Community Planning. The lead screening data were organized by social planning area for purposes of analysis. An estimate of the population at risk (children aged one to five) in each social planning area was estimated from birth rate statistics.

Results

Table 2 summarizes the results of the Cleveland Lead Screening Program for 1977-1978, as modified by clustering into those social planning areas, areas served by the Family Practice Center. The overall percent of screened children with a lead toxicity risk of class II or greater was 7.2 percent. For the Family Practice Center service area, the overall percent of screened children at a class II or greater health risk was 5.2 percent. Age distribution revealed that 66 percent of those in moderate to high risk categories were 0 to 35 months of age and that 33 percent were 36 to 60 months of age. Age specific prevalence rates for children ranged from 4.25 per 1,000 for Willard to 49.60 per 1,000 for Tremont. Estimated percent at risk population screened varied from a low of 14.27 percent for Elmira to 64.83 percent for Tremont. Since the calculated prevalence rate depends on the effectiveness of identifying those affected individuals, the low prevalence for Elmira and Willard may be artificially low as a result of the limited screening being performed in those areas. The estimated prevalence for lead toxicity in the United States is 10 to 30 cases per 1,000 children aged one to five years. On the basis of this survey it appears that lead poisoning is a health problem for children residing in the Family Practice Center community and that the family physician working in this

Table 1. Risk Classification For Asymptomatic Children[6]

Blood Lead Levels (μg/ml)	Erythrocyte Protoporphyrin (μg/100 ml) ≤49	50-109	110-249	≥250
≤29	I	Ia	Ia	EPP+
Not done	I	*	*	*
30-49	Ib	II	III	III
50-69	**	III	III	IV
≥70	**	**	IV	IV

Note: Classification reflects priority for medical evaluation from the screening results—not to be used for diagnostic purposes
EPP +: Erythropoietic protoporphyria; although rarely, iron deficiency may cause elevations to 300 μg/100 ml
* Blood lead necessary to estimate risk
** Combination of results not generally observed in practice; if observed, retest with venous blood immediately
Source: Lin-Fu JS: Preventing lead poisoning in young children. Bureau of Community Health Services (Rockville, Md). DHEW publication No. (HSA) 78-5143. Government Printing Office, 1978

community requires a framework for solving this problem. Also, the family practice educator teaching in this community requires a process and context based framework in guiding learners through this problem.

Discussion

The process illustrated is one of data gathering and organization on a community level to help clarify a health problem. Once a problem is identified, however, a model is needed that delineates the specific knowledge necessary to solve the problem and that facilitates the formulation of specific intervention schemes. The consideration of the problem in the context of individual, family, and community as illustrated in Table 3 is one model that may be used in family medicine. This model provides a method for integrating community medicine into problem assessment and resolution in the Family Practice Center.

Individual Level

Knowledge Base

On an individual level, the survey indicates that children within the target area are at high risk for the acute and chronic effects of lead exposure and that specific geographic areas are at especially high risk. Children are susceptible to environmental lead toxicity for two reasons. First, hand-to-mouth behavior and pica increase children's ingestion of lead dust and paint containing lead.[7-9] Second, children absorb more lead across the gastrointestinal tract than do adults.[10] Recent evidence also suggests children have greater impairment of heme synthesis with the same total body lead burden.[6] Surprisingly, the impact of lead on children's health is not clear, even though the syndrome of acute lead intoxication has been long appreciated.[11] Initially, screening programs were aimed at preventing symptomatic lead poisoning associated primarily with the ingestion of lead paint. In fact, combined screening and housing inspection has reduced the number of children with

Table 2. Cleveland Lead Screening Program: Family Practice Center Target Area, 1977-1978

Social Planning Area	Number Screened	Class II or greater No.	Class II or greater (%)	Estimated Population, 1-5 Years	Age-Specific Prevalence per 1,000	Percent Population Screened
Willard	245	5	(2.1)	1,177	4.25	20.8
Elmira	224	8	(3.6)	1,569	5.10	14.27
Denison	480	15	(3.1)	1,735	8.65	27.66
Clark-Fulton	652	23	(3.5)	1,896	12.13	34.38
West Side	905	49	(5.4)	2,292	21.38	39.48
Near West Side -Ohio City	1,216	74	(6.1)	1,966	37.63	61.85
Tremont	732	56	(7.6)	1,129	49.60	64.83

severe lead poisoning. The vast numbers of "asymptomatic" children with elevated body lead burdens, however, raises serious questions about the subtle neurological effects of chronic "low level" lead exposure. Biochemical investigations have shown that blood lead levels as low as 15 μg/ml inhibit mitochondrial incorporation of iron into protoporphyrins and neuron oxidative metabolism.[6] Psychological investigations have raised questions about the effects of lead exposure on intelligence, motor coordination, and hyperactivity.[12] A recent study by Needleman et al used dentine lead content as a marker for previous cumulative lead exposure.[13] They found children with high dentine lead performed significantly less well on intelligence tests, and teachers' evaluations indicated that nonadaptive classroom behavior increased in a dose related fashion to dentine lead.

Intervention

The risk of lead exposure is a significant health problem faced by the one- to five-year age group within the Family Practice Center catchment area. A routine finger-stick erythrocyte protoporphyrin analysis as a primary screening tool for lead toxicity for all children aged one to five years living in high risk areas is recommended by the Center for Disease Control. Routine screening is an essential Family Practice Center service, and development of a protocol for intensive screening of children residing within the high risk community segments is a logical next step.

Family Level

Knowledge Base

Ingestion of lead paint within the home represents the major cause of acute lead poisoning. To have an impact upon this problem, communities such as Cleveland have developed housing inspection programs that have legal authority to require removal of the lead risk to the child. This authority includes the right to temporarily remove the child from the home. Also, a child with few symptoms may have lead levels that require hospitalization and painful chelation therapy. Both represent major stresses upon the family system.

Intervention

Anticipatory guidance and family education regarding lead risks within the home are important

Table 3. Exposure of Children to Environmental Lead

Levels of Care	Family Medicine Knowledge Base	Family Practice Interventions
Individual	Age and individual risk factors	Age and location adjusted screening program
	Physiology	Specific intensified follow-up of high risk children
	Nutritional interactions	Screening and treatment of iron deficiency
	Syndromes of acute intoxication, and low level chronic effects	
	Screening techniques, classification, and recommended follow-up	
	Therapy	
	Physiological impact	
Family	Risk factors within the home	Family census tract-based medical records system
	Effect of parents' occupational exposure on child	
	Legal rights and responsibilities for home environment	
	Impact of child in high risk lead classification on the family system	Family education and anticipatory guidance to reduce risk factors
	Legal statutes affecting placement of child with high chronic lead levels	
Community	Environmental sources of lead: housing, industry transmission	Investigation of local environmental risk factors
		Community education
	Interrelationship of lead exposure and seasonal variation, nutritional factors, and ethnic groups	Collection of local data for community use in environmental improvement
		Community advocacy

interventions on the family level and aid the family physician in preventing these stresses on the family system.

A family based, geographically indexed records system enables a physician to identify quickly children at high risk for lead poisoning while caring for an individual family. Elevated erythrocytic protoporphyrin values in a sibling or a residence within a targeted community segment should alert the physician that careful evaluation for lead tox-

icity may be necessary. Family and community risk factors can be incorporated into an individual's health care in much the same way that cardiovascular disease risk factors are currently used. A parental occupational history of a job with high lead exposure should alert the physician to the need for lead screening of the family members.

Community Level

Knowledge Base

Implementing the above programs will make the most of the Family Practice Center's role in preventing lead poisoning in children as it is currently defined. The problems of chronic, low level lead exposure, however, can best be addressed on a community level, and such "borderline elevations" are more common among urban than rural children.[14] For example, Lepow et al recently investigated environmental lead sources in ten urban children with chronically elevated blood lead levels.[5] Based on multiple samples from the children's homes, they estimated a child's daily intake of lead from various sources and found air, paint ingestion, dust, dirt, food, and water all provided significant contributions to body lead acquisition. Demographic factors, poverty, housing quality, traffic patterns, industrial density, and weather patterns will alter these sources for any given community; consequently, although the data presented are helpful in identifying high risk community segments, they do not delineate the causes of lead problems within those communities.

Intervention

Community efforts to lower lead risks depend upon identification of local factors that contribute to elevated lead exposure. The role of the family physician as advocate for his or her patients, their families, and their community in the identification of sources of lead acquisition and in working toward the elimination of these sources is the essence of community level intervention. Effective channels of communication with the local health department and with other health care providers in the area will facilitate the development of a network responsive to community needs and will aid in their fulfillment.

Conclusion

This survey illustrates a method for integrating community medical concepts into the day-to-day workings of an urban family practice center. Use of the various levels of the practice model in visualizing and organizing knowledge and interventions provides a structure that facilitates the teaching of community medicine to the family physician. In addition, it helps the family physician ask about approaches to a health problem that make the most of effective intervention.

References

1. Special requirements for residency training in family practice. In Essentials of Approved Residencies. Chicago, American Medical Association, 1973
2. Donsky J, Massad R: Community medicine in the training of family physicians. J Fam Pract 8:965, 1979
3. Engel GL: Enduring attributes of medicine relevant for the education of the physician. Ann Intern Med 78:587, 1973
4. Medalie JH (ed): Dimensions of family medicine and practice. In Family Medicine: Principles and Application. Baltimore, Williams & Wilkins, 1978
5. Lepow ML, Bruckman L, Gillette M, et al: Investigations into sources of lead in the environment of urban children. Environ Res 10:415, 1975
6. Lin-Fu JS: Preventing lead poisoning in young children. Bureau of Community Health Services (Rockville, Md). DHEW publication No. (HSA) 78-5143. Government Printing Office, 1978
7. Mehaffey K: Quantities of lead producing health effects in humans: Sources and bioavailability. Environ Health Perspect 19:285, 1977
8. Baltrop D: The prevalence of pica. Am J Dis Child 112:116, 1966
9. Baltrop D: Children lead. Am J Dis Child 127:165, 1974
10. Alexander FW, Ckyeow BF, Delves HT: The uptake of lead and other contaminants. In Environmental Health Aspects of Lead. Amsterdam, Commission of the European Communities and the United States Environmental Protection Agency, 1972
11. Cohen AJ: Lead poisoning: 20 years later. Clin Pediatr 19:245, 1980
12. Landrigan PJ, Whitworth RH, Baloh RW, et al: Neuropsychological dysfunction in children with chronic low level lead absorption. Lancet 1:708, 1975
13. Needleman HL, Aunnoe C, Leviton A, et al: Deficits in psychological and classroom performance of children with elevated dentine lead levels. N Engl J Med 200:684, 1979
14. Needleman HL (ed): Low Level Lead Exposure: The Clinical Implications of Current Research. New York, Raven Press, 1980