Infectious Diseases Common to Animal and Man of Occupational Significance to Agricultural Workers

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The health of man is intimately associated with the health of animals with which he is in close direct or indirect contact. One very important association is the infectious diseases that man and animals have in common. There are four types of relationships that exists in terms of disease transmission between animals and man:

1. disease of vertebrate animals transmissable to man and other animals, (zoonoses);
2. diseases of man transmissable to other animals,(anthropozoonoses);
3. diseases of vertebrate animals chiefly transmissable to man, (zooanthroponoses); and
4. diseases transmissable to man from the environment (animals being the source of environmental contamination).

In common usage, a distinction is often not made between these four types of relationships and the term zoonoses may be used for any of the diseases common to animal and man. The 1967 Food and Agriculture Organization/ World Health Organization, Expert Committee on Zoonoses,[8] listed over 150 diseases that man and animal have in common. Domestic livestock may be affected by a number of these diseases, thus the reason for concern for health of those who work involves direct contact with livestock, or indirect contact through contamination of the work place. Many feral animals and domestic non-livestock species also share diseases with man and offer a potential occupational hazard when the agricultural work place encroaches on the ecological niche of these species.

Review of Literature

Many reports and articles have been published which indicate that there are several diseases common to animal and man for which agricultural workers represent a population-at-risk, due to the occupational-environmental relationships.[9,16,19,23,27,28] Top, et. al. 1962,[27] described twelve occupational zoonotic diseases thought to be significant to the health of agricultural workers. This article discussed the mode of transmission and some of the basic health effects on the individual. West, 1964,[28] indicated that farming has the second highest occupational disease rate compared to other occupational groups in California. One case of tetanus and two cases of brucellosis were cited as examples in this report. Steele, 1968,[19] has reported on the relationship of animal-borne diseases to occupational health in agriculture. History, worldwide perspective, and trends were considered for 32 zoonotic diseases. However, little documentation was noted to differentiate the agricultural occupational group from the general rural population. Disease rates were not presented. Saltzman, 1970,[17] has reported on rural occupational health from a practitioner's point of view. He indicated that "... farmer's illnesses were peculiar to farmers alone." Tularemia and undulant fever were listed as examples of diseases for which agricultural workers were a special risk group. The rural environment was indicated as the source, but again there existed no documentation to differentiate the agricultural workers as a high risk population, as compared to the general rural and general urban populations.

A 1964,[9] report from the Canadian Department of National Health and Welfare on industrial hygiene problems in agriculture cited problems in diagnosing and reporting as responsible for lack of information on incidence of occupational disease acquired from animals. The report further states that research and evaluation will be necessary to establish the true importance of zoonoses as hazards of agricultural workers. A joint International Labor Organization/World Health Organization Committee considered the occupational health problems in agriculture.[16] The 1962 report indicated that the agricultural worker as compared to the urban dweller is more likely to encounter

disease agents and have more frequent and longer lasting illnesses. The report also described the difficulty in determining the occupational relationship of zoonotic diseases. A total of 45 diseases (several of which do not occur in the U.S.) were categorized arbitrarily into 3 groups as follows:

1. diseases principally contracted through an agricultural occupation;
2. diseases occasionally contracted through an agricultural occupation; and
3. diseases questionably contracted through an agricultural occupation.

No documentation in the form of incidence rates, prevalence rates, case reports, etc., was given to support the categorization.

A summary of previously published reports and articles on the occupational nature of zoonotic diseases includes the following points:

1. several diseases have been indicated as occupational diseases;
2. very little data are given to document these statements;
3. of the total number of zoonotic diseases, relatively few are mentioned as occupational diseases. Only one report attempted to rule out those zoonotic diseases which are not occupationally acquired;
4. lack of data causes difficulty in determining the occupational nature of zoonotic diseases.

Objectives

The Occupational Health and Safety Act of 1970 has created the need for a critical analysis of the health hazards of zoonotic diseases to agricultural workers. There has not been a comprehensive study that has attempted to bring all relevant available data to focus on this subject. Previous reports have not considered the full spectrum of diseases common to animals and man, and most have relied heavily on subjective expert opinion rather than documentation. Thus, a critical review of pertinent data (state-of-

the-art), was undertaken so that objective action could be taken to deal with diseases common to animals and man in perspective with other health problems of agricultural workers.*

The objectives of this study were as follows:

1. To compile a list of diseases common to animal and man in the United States that may have some potential as an occupational health hazard of agricultural workers.
2. To review the data relevant to the relationships of these diseases to the occupational health of agricultural workers.
3. Analyze the data and, if possible, to accept or reject for each disease the hypothesis that it is an occupational health problem for agricultural workers.
4. To place each disease in one of three categories according to the relative risks of agricultural workers as compared to the general rural population and general urban population:
   a. Diseases for which agricultural workers have a <u>definite risk</u>.
   b. Diseases for which agricultural workers have a <u>questionable risk</u>.
   c. Diseases for which agricultural workers have a <u>doubtful risk</u>.

Procedure

A total of 49 diseases were selected by the author for study from a list compiled by the Center for Disease Control of 170 diseases common to animal and man.[3] The selection was based on the plausibility of the diseases as occupational health problems of agricultural workers, according to the occupational-environmental relationships of the diseases in man and the disease in nature, Table 1. The diseases were then subjectively categorized according to their plausible importance as occupational diseases, based on

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authors opinion. It is emphasized that the listing was subjective and served only as a study list. Those with highest plausibility as occupational diseases of agricultural workers were placed in the first priority for further study. Those of lower plausibility for occupational disease of agricultural workers were placed in the second and third priorities.

The literature was reviewed for each disease. Pertinent data were collected which would support or refute the statement that agricultural workers have a greater probability of contracting the disease as compared to other populations at risk. The following types of data were considered:

1. exposure potential for the agricultural worker - extent of animal reservoir and mechanisms of transmission from animal to man;
2. case reports;
3. morbidity and mortality reports;
4. isolations of the etiologic agents;
5. serological surveys; and
6. epidemiologic studies.

The pertinent data were then evaluated and the diseases were recategorized according to their importance as occupational diseases of agricultural workers. The following categories were used: 1) definite risk; 2) questionable risk; and 3) doubtful risk. For the purpose of this review, occupational disease was defined as a disease which is contracted as a result of actual work activities or contracted through environmental exposure in the work place.

The data reviewed for the individual diseases were too voluminous to include in this paper, and are reported elsewhere.[2] What will be reported in the paper are:

1. a summary and analysis of the data collected, and
2. a discussion of the problems encountered in obtaining pertinent data.

Table 1

Study List for the Comparative Medicine Section of the State-of-the-Art Report on Occupational Safety and Health in Agriculture

First Priority*	Second Priority	Third Priority
1. Brucellosis	1. Salmonellosis	1. Trichinosis
2. Leptospirosis	2. Listeriosis	2. Pasteurellosis
3. Toxoplasmosis	3. Staphlococcal infections	3. Erysipelas
4. Rabies	4. Taeniasis	4. Cutaineous larval migrans
5. Tetanus	5. Echinococcosis	5. Visceral larval migrans
6. Anthrax	6. Collibacillosis	6. Rocky Mt. spotted fever
7. Erysipeloid	7. Tuberculosis	7. Colorado tick fever
8. Pseudotuberculosis	8. Streptococcal Pharyngitis	8. Strongyloidiasis
9. Q. Fever	9. Influenza and parainfluenza	9. Pneumococcal infections
10. Psittacosis/ ornathosis	10. Dermatophilosis	10. Encephalomyocarditis
11. Histoplasmosis	11. Tularemia	11. Dirofilariasis
12. Blastomycosis	12. Plague	12. Sporotrichosis
13. Ringworm	13. Cryptococcosis	13. Babesiosis
14. Equine Enceph-alitis	14. Acariasis	14. Fascioliasis
15. Newcastle disease		15. Balantidiasis and giardiasis
16. Vibriosis		
17. Cowpox		
18. Pseudocowpox		
19. Vesicular stomatitis		
20. Contagious Ecthyma		

*Priority refers to the plausibility of the disease as an agricultural occupational health hazard. The pertinent literature was reviewed for these diseases in this order of priority in attempt to substantiate or disprove the occupational hazard to agricultural workers.

Results

Table 2 represents conclusions and interpretations of the relevant literature, available published and unpublished data regarding diseases common to animal and man, relative to the occupational health of agricultural workers. The diseases are categorized according to the risks of agricultural workers relative to the general rural and general urban populations. The diseases are not necessarily listed in order of importance.

Discussion

This table represents the best effort to separate out those diseases of occupational significance to agricultural workers from the 170 diseases listed by the WHO which are common to animal and man. According to the author's interpretation, of the available data, those listed in the definite risk category were documented as occupational health hazards. The available data were not adequate to define the occupational significance of several diseases. These were listed in the questionable category. No relationship to agricultural occupations were found for those listed in the doubtful risk category.

Due to the problems in data collection, rates were generally not available. Thus, interpretation was required of less direct types of data (previously listed) to arrive at the final categorization. Also due to problems of data collection, quantitation and ranking of the diseases in order of importance was not feasible.

Problems of Data Collection - One of the problems associated with this study was that direct and pertinent data regarding the subject are limited. As mentioned, previous reports and articles on the subject have dealt in very general terms with very little substantive data. One report specifically states that lack of data is a very real problem in dealing with this subject.[9]

Table 2

The Occupational Significance to Agricultural Workers of Selected Diseases Common to Animal and Man: Risk for Agricultural Workers in Comparison to the General Rural and General Urban Population

	Definite Risk		Questionable Risk		Doubtful Risk
1.	Brucellosis	1.	Pseudotuberculosis	1.	Cowpox
2.	Leptospirosis	2.	Psittacosis/ornithosis	2.	Taeniasis
3.	Toxoplasmosis	3.	Vibriosis	3.	Dermatophilosis
4.	Rabies	4.	Salmonellosis	4.	Trichinosis
5.	Tetanu	5.	Listeriosis	5.	Pneumococcal Infections
6.	Anthrax	6.	Tuberculosis	6.	Babesiosis
7.	Erysipeloid	7.	Streptococcal Infections (pharyngitis, Erysipelas)	7.	Fascioliasis
8.	Q Fever	8.	Influenza and Para-influenza	8.	Giardiasis
9.	Histoplasmosis	9.	Plague		
10.	Blastomycosis	10.	Cryptococcosus		
11.	Ringworm	11.	Nematodiasis (cutaneous Larval Migrans, Visceral Larval migrans, and Strongyloidiases		
12.	Equine Encephalitis	12.	Colorado Tick Fever		
13.	Newcastle Disease	13.	Pneumococcal Infections		
14.	Pseudocowpox	14.	Encephalomyocarditis		
15.	Vesicular Stomatitis	15.	Dirofilariasis		
16.	Contagious Ecthyma				
17.	Staphlococcal Infections				
18.	Echinococcosis				
19.	Collibacillosis				
20.	Tularemia				
21.	Acariasis				
22.	Pasteurellosis				
23.	Rocky Mountain Spotted Fever				
24.	Sporotrichosis				
25.	Balantidiasis				

An article considering the zoonoses as occupational diseases discussed some of the basic problems in getting accurate and meaningful data.[1] The article mentioned that case reports and general articles in the literature are numerous, and tend to indicate an occupational relationship. However, the article goes on to say, "Readily, it becomes apparent that all too infrequently is suitable information available as to the number or percentage of victims exposed at work. What is most striking of all is the lack of statistical information, regarding occupational zoonoses in reports, incompliance with the occupational disease reporting laws common to nearly all states, and similar data in connection with the Workmen's Compensation Commissions."[11] Five factors are present which negate the possibility of getting incidence information from these sources:[11,27]

1. lack of compliance with occupational disease reporting laws in most states;
2. in those states where occupational disease reporting is practiced, zoonotic diseases often are not differentiated, and grouped under the general heading, infections;
3. mild cases are often not reported;
4. until fairly recent times, most agricultural workers were not required to be covered under jurisdictional compensation coverage.

The following statement summarized the state of existing pertinent data, "... there are no official statutes that may be accepted as revealing the true frequency of zoonoses as occupational diseases."[11]

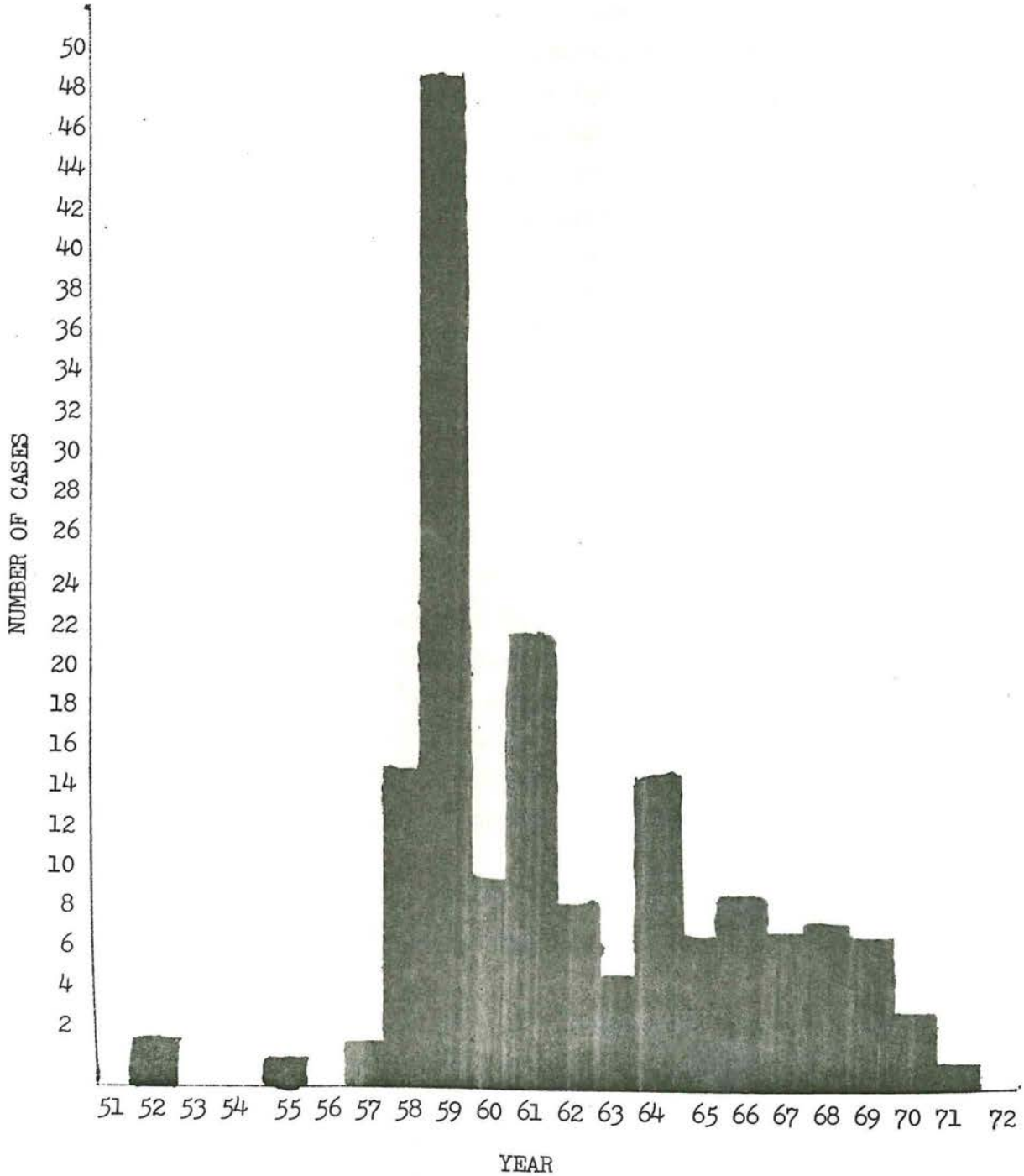
Two insurance companies in the Midwest who insure employers of agricultural workers against claims of occupationally acquired illnesses, were contacted for possible information on risks of agricultural workers acquiring infectious diseases from animals. Both companies indicated they had very little of this kind of information, and although they need the information, they have found such information to be unavailable.[17] The lack of data gives a false picture of the actual problem. Underdiagnoses, lack of reporting, and failure to associate the agricultural occupation with the disease are

specific problem areas which are common, in varying degrees, to all zoonotic diseases. The disease leptospirosis is no exception to this problem. However, for this particular disease, there are data available which will lend evidence to document the reasons for lack of data. The reasons would be similar for many of the zoonotic diseases. The problems of lack of data and thus the difficulty to determine the actual health effects of the disease as an occupational health problem for agricultural workers can be demonstrated by example, using some data collected for leptospirosis.

Problems of Data Collection - Exemplified by Leptospirosis - The Comparative Medicine Section of the Institute of Agricultural Medicine Section of the Institute of Agricultural Medicine at the University of Iowa, was involved in a study on the epidemiology of leptospirosis between the period 1956 to 1970. The results of these studies indicated that leptospirosis is a disease that can be readily found if looked for,[26] thus prevalence and reporting is often a reflection of the expertise and interest in this disease in a specific area.[21] Figure 1 indicates cases of leptospirosis reported in Iowa over the past 23 years. During the latter part of the 1950's, the number of cases appeared to increase. This trend continued until the late 1960's and early 1970's. The increase in reported cases is paralleled by the leptospirosis research activities, which started in 1955 and ended in 1970, carried on by the Comparative Medicine Section of the Institute of Agricultural Medicine, University of Iowa. When the case finding activities, epidemiologic studies, and laboratory diagnostic facilities of the unit were discontinued, the number of reported cases dramatically declined. This relationship of interest in the disease, and cases reported, was also realized by a report on the status of the disease in Massachusetts.[22] Protein clinical signs, lack of adequate laboratory support, lack of awareness of the disease by physicians, and inadequate research facilities are inter-related factors responsible for the lack of recognition and reporting of cases.

Many cases are probably either subclinical or sufficiently mild so that the individual fails to report to a physician. Spontaneous recovery may occur, which apparently was the situation found in the study of a cohort in

Figure 1 - Numbers of Human Cases of Leptospirosis in Iowa 1951-1972.[7,29]



*These cases were documented by McCulloch et. al.,[12] but not reported in the Iowa Morbidity Report published by the Iowa State Department of Health.

Nebraska;[15] two individuals were found positive in a serological survey, and reported previous symptoms were very suggestive of leptospirosis, but they were never seen by a physician. The occurrence of subclinical cases is indicated by the lack of history of clinical disease in many positive reactors in serological surveys.

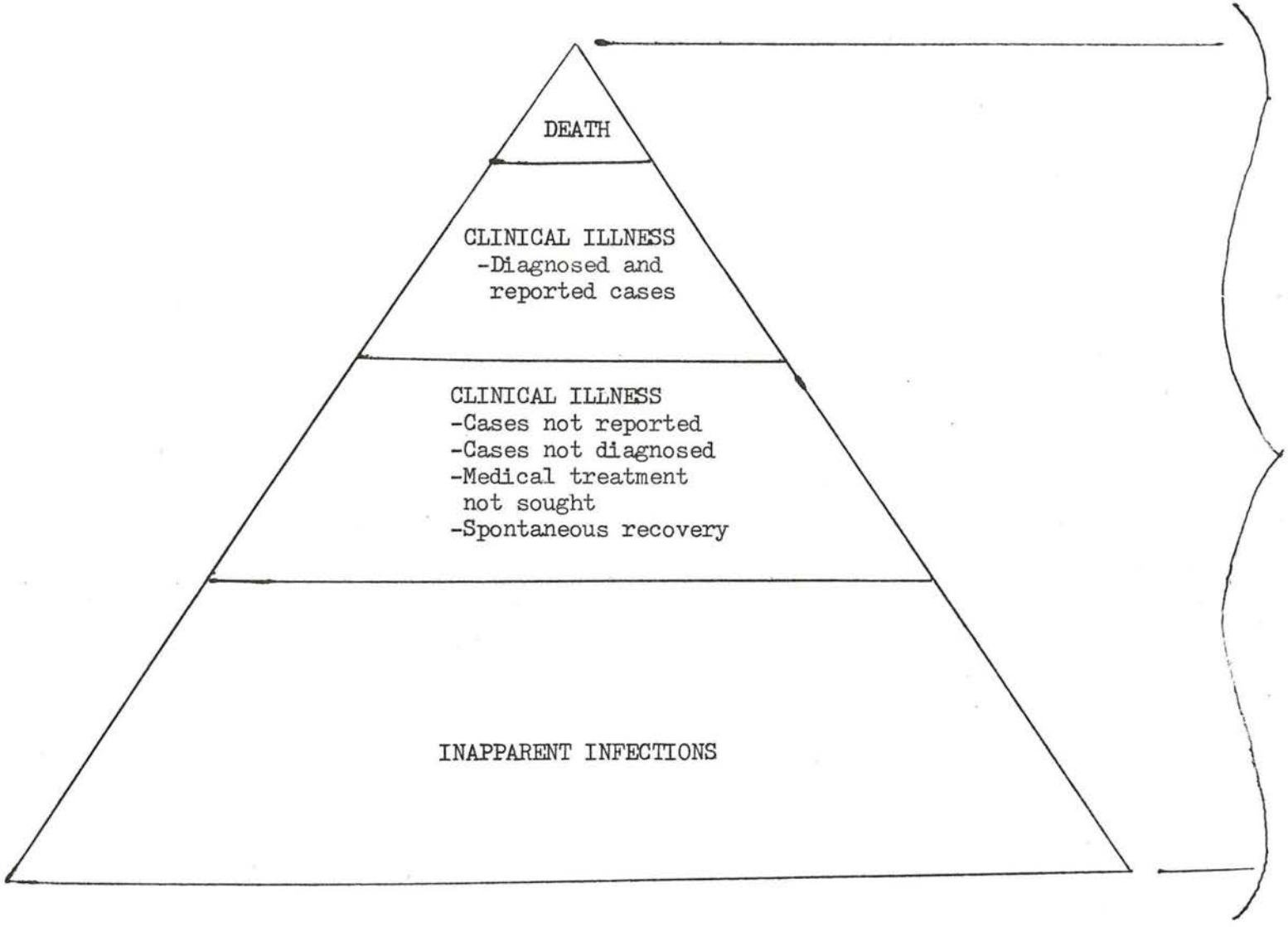
Problems of Data Collection: Health Effects - Exemplified by Leptospirosis - The health effects of a disease transmitted from animal to man must take into consideration the physical, mental and social well being, and not merely the absence of diseases or infirmities, (according to the definition of health by the World Health Organization).[10] The physical effects can be taken from morbidity and mortality reports, and case reports. Figure 1 indicates the reported cases of leptospirosis for the period 1947-1970.[29] During the past decade the average number of reported cases has been 83 per year. Approximately 62% to 74% of the reported cases have required hospitalization and the length of stay has been in the range of 1-3 weeks.[5,20] An average of 14 deaths per year due to leptospirosis has occurred during recent years.[29] The case fatality rate is much higher for the age group above 50-years.[20,25]

The recorded morbidity and mortality are thought to be only a minor portion of the total health effects of this disease, and have been compared to the tip of an iceberg in that the major part of the problem is not obvious.[12] Figure 2 indicates that undiagnosed cases, unreported cases, subclinical illness, chronic physical effects, and mental stress, are factors that are not obvious in the disease picture. In many instances, only those cases with more severe clinical signs are diagnosed.[5,25] Leptospirosis has been referred to as "... one of the least diagnosed diseases in the world."[21]

There are several reasons why the more mild forms of the disease are probably often not diagnosed or reported:

1. Protean clinical signs. The disease may mimic influenza, various central nervous system disturbances, and other febrile origin diseases.[5,13,14]

Figure 2 - Iceburg Model: Disease Spectrum in Man for Certain Zoonotic Diseases



2. Lack of adequate laboratory support.[1,6,18,21,24]
3. Lack of awareness of the complete disease picture among physicians.[4,5,13]

Conclusions

The stated objective of the OSHA is to insure a safe and healthful work environment. Before effective measures can be taken to prevent occupational diseases, transmitted from animals, the problem must be defined. The paper is only the first step in defining the problem. The next step would be to quantitate and identify regional differences in problems. Setting priorities and policy would be a step further, and the final step would be to establish control programs and monitoring of results. The problems in data collection make this progression quite difficult. The most acute deficiencies are the facts that total numbers of reported cases are invalid, and denominator values are not available in most cases.

It is suggested that a task force consisting of 5-10 experts in the field may be able to make progress towards a more complete defining of the problem than any individual. A priority of the task force would be to develop the resources of data gathering. Specific geographic areas could be recommended for in-depth studies. Areas could be designated to determine disease rates so that a true national picture of the occupational nature of these diseases may be obtained.

Certain zoonotic diseases have been suggested as occupational hazards for certain groups of agricultural workers for many years. The Occupational Safety Act of 1970 has forced a more critical evaluation of this problem. Inadequacies in the disease reporting systems and other data sources do not allow a valid analysis of the problem in terms of importance in comparison to other occupational health problems of agricultural workers. To obtain the needed information, a new approach with substantial committment to the problem is necessary, rather than a revamping of present reporting systems.

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