In children, however, a mere restoration to a previously achieved state is obviously not enough. We have to produce evidence that the child is advancing at the rate which was suitable for him and that he has not been held back by the fact that he has missed experience which would have been encountered normally.

Then we cannot dodge the consequences of the admitted fact that we do not expect children to be self-maintaining. Therefore, the adults and the children who make up the child's social environment are factors which cannot be ignored.

With these considerations in mind we have attempted to work out a method of investigation which might reveal intellectual and emotional deviations from predicted curves of development.

Using experience with many types of encephalitis as a basis, a series of cases of infantile paralysis have been observed over a considerable period. In a general way the strictly psychometric approach has not seemed particularly useful, since gross general defects as revealed by estimation of intelligence quotients have not been seen. As psychologic procedure the qualitative rather than quantitative approach was used. Visuomotor, learning tests, reasoning tests, and general sensorimotor tests were of most striking value.

Beyond these technical tests observations were carried on concerning the quality and type of mental functioning. The possible bearing of prolonged immobilization and hospitalization was studied.

The material consisted of a series of seventy children with definite poliomyelitis. About fifteen of these patients were regarded as having cerebral involvement, whereas the rest were not so classified.

Some of the cases have been followed for several years and others are very recent. In the cases which had evidence of cerebral involvement, visuomotor deviations which impaired comprehension of spatial relationships were found in almost all cases in some degree. It is quite clear that disorders of this sort handicap the child if he is required to deal with the symbols which are so necessary in school. Difficulties in learning habits, lack of sustained effort, short attention spans, and irritability were frequently found.

The spinal cases, as defined by the usual criteria, were frequently somewhat handicapped in the same way, but the difficulties were neither as severe nor as enduring as in the encephalitic group.

It is the universal experience of pediatricians that children from one to three who have to stay in hospitals for long periods do poorly. If immobilization is added to hospitalization in the ordinary sense it might reasonably be expected that difficulties would increase. From observation of development it is clear that experience and activity are necessary for early development and a study of this element is being pursued. Enough information is available to make it clear that immobilization is an important barrier to orderly progress.

Another series of difficulties arise in the hospital from the concentration of attention upon deformity. Other problems arise from the inevitable lack of time for arranging matters so that a child can understand what is going on and what is done to him and how long he is to stay. Since there is no age limit for the disease it is clear that some patients are old enough to understand or mis-

understand every bit of medical conversation, but almost none of them are mature enough to force the medical staff to deal with their anxieties.

The situation does not lend itself to any easy solution. The superb skill of orthopedists in dealing with the deficits in the anterior horn cells and resulting disabilities is recognized. Most of the orthopedic thinking is based on the simple process of subtraction. So many units are gone, so many were there to start with. The sum is mathematically calculated and steps are taken to exploit the remainder.

If, however, the problem is not so easily stated or so readily solved a new approach is justified. It seems to us clear that there are genuine though perhaps not permanent intellectual deviations in certain cases. In all cases the management of the children is different from that of adults.

During the stay in the hospital the younger group suffer from absence of activity and almost certainly from absence of the warmth of affection which they should be having. All children are almost certainly subjected to anxieties which are not readily or automatically resolved.

After discharge other problems arise and seem to call for proper guidance from the psychologic point of view.

It seems important to mention the emotional disturbances caused in children who, back in their own circle, find themselves unable to compete socially, either by the nature of their physical handicap itself or by their parents' increased anxieties, and by necessity for rest, exercises, and the like. In other cases the parents' attitude seems to lead in an opposite direction. The child is urged to compete and to overlook his own difficulties. In other instances the child's reaction to regained freedom of activity leads to abnormal aggressiveness and exuberance.

The material which we have collected suggests that a serious effort should be made to protect these children from as many of the consequences of the disease as possible. The role of psychologic appraisal has been suggested. The method of instruction of children, parents, and teachers is so dependent on the personnel of the hospital that it is impossible to lay down rules, but it seems clear that mental and emotional difficulties are just as real a handicap to certain children as the paralysis is to others.

It is our impression that the inclusion of psychologic study is a reasonable and probably an essential part of the management of infantile paralysis. We are quite aware that behavior does not depend upon intellectual equipment alone, and we are equally sure that no hospital management can prevent all emotional difficulties.

It is quite evident, however, that almost every case of infantile paralysis will be cared for in hospitals during the acute stage and in specialized clinics later. What is done or not done in hospitals is of enormous importance. If by subjecting hospital procedure to review we can help the victims of infantile paralysis to make the transition from immobilization to activity and from the hospital to home and school with minimal difficulty, we need to appraise the intellect and consider the emotions and keep close contact with parents and child.

Getting acquainted with your brace

by REINETTE LOVEWELL DONNELLY
who has worn braces since childhood

"Soon," the doctor announces, "we'll take the measurements for a brace on that left leg. That will help with the walking."

This year, as in every year, such a decree will go forth for hundreds of children who have had a bout with infantile paralysis — youngsters who cannot walk and run as they used to do before the sudden sickness called "polio" struck them down. Mothers will listen eagerly, sure that this is good news.

It may be a brace for one leg or an arm splint or some other appliance. Whatever it is, this brace will be a real friend. It will protect weak muscles while they grow stronger. Without its help the arm or leg might grow out of shape — become deformed. When the doctor finds that the muscles are strong enough, the brace will come off. That is something to look forward to!

There are a few children who will always need the support of a brace. It will be their friend for life. Because of it, they will be able to do all sorts of things they could never manage without it.

The child who gets about with the assistance of a brace has a right to be a little proud. He is doing something more difficult than anything his playmates do. He is in good company. He belongs to a fraternity which has included a president of the United States, who wore leg braces at Teheran and Yalta and was able to make people forget that he had to depend upon steel frames to hold him up.

A brace sometimes feels a little uncomfortable at first, but if it fits properly, the wearer soon becomes accustomed to it and is glad of its support. If after wearing it a day or two it still feels

uncomfortable, if it hurts or chafes the skin, there is something wrong that should be put right. Perhaps the brace needs to be refitted, or the straps that hold it in place are too loose. To get the best use out of a brace, it must be just right!

It takes a little time to get acquainted with a brace and learn all its tricks. One of the most important things to discover is that it pays to give it the very best treatment and protection. These supports of steel and leather, jointed and strapped and laced, are expensive equipment. Their cost has risen many per cent in the chaos brought about by World War II. Repairs are costly, and, when only one brace is on hand, it may have to be surrendered to the brace-shop for hours or days. Braces have a way of breaking down the day the circus comes to town, or its owner has an invitation to a birthday party. Such childish tragedies can usually be averted by a daily routine of inspection. A loosened screw, a worn strap-hole, if caught in time, may save a lot of mental anguish.

Much worse than the cost in money and the disappointment is the danger of injury to muscles that are being coaxed back to normal action by the stern discipline of braces. It's a bad business to take chances.

A BAG PROTECTS BRACES

There is a constant tax on brace joints and their locks. Besides the wear and tear of use, lint and dust do serious damage. Some of this accumulation can be blown out but it will be necessary to use a knife with a thin edge, or a razor blade, to get out every particle of dirt. Such sharp instruments are, of course, not for children's hands. Children can be taught to do a good job of cleaning their braces with a toothpick or hairpin. Bracemakers invariably inspect joints first when looking for trouble.

One cause of dust collection is the habit of shoving a brace under the bed at night. Even in the cleanest home lint appears almost as soon as it is removed. Cats and dogs like to run around under beds and frequently "shed." These hairs may work into brace joints and do damage by clogging.

sanitary is a tough problem. The pessimists say it simply cannot be done — but here are some suggestions:

Saddle soap and soap and water have been accepted as the only cleansing agents. Saddle soap is the standard treatment for leather and if applied in accordance with directions which accompany it, will be effective in some degree. It is necessary to wipe it off carefully and thoroughly, or clothing will be injured. If a mild soap and water are used it will take quite a time to dry and the brace cannot be worn immediately.

The familiar dry-cleaning fluids are to be strictly avoided as they dehydrate or dry leather and may do damage. One device for a leg brace is to cut off the foot of a stocking and draw it up over the rim of the brace for protection. As this can be changed daily, it can be kept clean.

BRIGHT AND SHINING

Braces have a way of becoming shabby. This is distressing to the wearer and causes self-consciousness. Worn and scuffed braces are likely to spoil all the pleasure of new clothes. Keep them bright and shining.

If all visible leather work is cleaned and polished, shoes kept in the best possible condition with fresh lacings and daily shines—if tan or black—and a good cleaner applied to white shoes, the whole brace will take on a smarter appearance.

SOMETHING TO CHEER ABOUT

A new trick that will appeal to many brace wearers is to cover the parts of the leather that come in contact with the skin with plastic film. This may be purchased at most large department stores and mail order houses. This material is sold by the yard for less than a dollar. It is non-porous, very light in weight (a yard only weighs a quarter of a pound) and can be used for lining any part of the brace. A great variety of colors is available, tan perhaps being the most desirable for the purpose. It is surprisingly tough. It does not crack. Extremely cold or hot climates have no effect upon it.

A simple solution is a brace bag, easily made from sturdy material like denim or awning cloth, zippered down the side or across the top. Pockets, also fastened with zippers, are a convenience for extra shoelaces and screws. This bag can be hung by a strap on a door knob, or stood erect in a corner.

OILING IS GOOD MEDICINE

Wherever two metal parts rub together there is need of oil. Practice will show you what is just the right amount, for this depends upon how much and how long each day the brace is used. Any excess should be wiped away to prevent soiling of clothing and injury to leather.

The type of oil used for sewing machines and general household lubrication will work successfully, or a half teaspoonful of vaseline, melted and applied, will form a protective coating when it thickens again.

Oiling not only protects the brace from wear, but prevents embarrassment. It is distressing to hear a squeak with every step if the brace goes suddenly dry. This has been known to happen in the silence of a church on the way to a front pew. No one likes to be conspicuous in this way.

ARE SCREWS AND RIVETS TIGHT?

In children's extension braces, screws frequently loosen and weaken the support of the brace. It is important to have on hand a supply of screws of the right size in the event any are lost. If screw material is so soft the thread wears down, new screws should be put in at once.

Rivets need to be watched. At any sign of weakening, the brace man is the best doctor. Rivets which fasten buckles are vital, as the unfastening of a strap may have serious consequences.

SHOES CAN CAUSE TROUBLE

Under any condition children's shoes wear quickly. When worn with a brace it is of the utmost importance for them to be kept in repair.

Heels of shoes sometimes become so worn that the steel framework of the brace touches the ground. Even a slight wearing of the shoe heel may change the position of the brace and throw hip and knee out of line.

If soles are thickened or heels built up, they should be kept exactly as prescribed even if it means weekly repairs.

In the type of brace where the shoe is pulled on over a foot plate or "sandal", an active child may get sand, grit or pebbles into the shoe. These may act as an abrasive and wear the plate to a cutting edge, which will cause damage to the shoe.

Knotted shoestrings are always a hazard. Keep them untangled.

EMERGENCY REPAIRS

A brace kit is insurance in time of trouble. It can be fitted out in a box or drawer, or put in pockets of the cover made to protect the brace when not in use. The kit should contain:

Screws of right size for replacements and a screw driver to fit them. Shoelaces of right length and thickness.
Rubber sponge to be used for relief against pressure of brace if bracemaker cannot be contacted immediately.

The adhesive felt called "moleskin" may be bought at drugstores in varying thicknesses. This helps out when rivet or worn leather exposes skin to friction. Raw spots are not only painful, but present the danger of infection.

KEEPING CLEAN

The leather work of a brace and whatever material is used for lining is likely to be the place where deterioration shows most quickly.

Perspiration is hard to control and plays havoc with leather. In some climates dampness causes mold. Wetting of any sort is disastrous.

Keeping leather work of hip-length and body braces clean and

sanitary is a tough problem. The pessimists say it simply cannot be done — but here are some suggestions:

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This plastic film can be washed with soap and water and dried at once with a towel in as simple an operation as washing face and hands. Wiping off the brace lining at night can be the same sort of routine as brushing teeth or laundering stockings.

The bracemaker will fit and secure this lining to the brace, if it is already being worn, or include it in the process of production, if new.

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THE NATIONAL FOUNDATION *for* INFANTILE PARALYSIS

Franklin D. Roosevelt, Founder

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INFANTILE PARALYSIS

the disease and its treatment

prepared by
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FOREWORD

Since the elimination or curbing of the great epidemic diseases of childhood, such as smallpox, diphtheria, and summer complaint, no disease creates a greater apprehension among people than Infantile Paralysis—not because of its mortality or even its incidence rate in epidemics, but because it may produce such tangible and lasting crippling in the victim it does claim. This fear has led to much discussion, much publicity in the press, and the advocacy of nostrums and treatments which are heralded as "cures." The burden of the care and rehabilitation of crippled children has long been the main work of medically and surgically trained specialists who derive their very name of orthopaedist from the fact that they are dedicated to the straight child (orthos pais). It has accordingly seemed wise to the American Orthopaedic Association in the midst of all this clamor to set forth in a brief primer the basic knowledge and the methods of treatment which have been found generally to produce the best results in the care of poliomyelitis cases.

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INFANTILE PARALYSIS
the disease and its treatment

DEFINITION

Poliomyelitis or Infantile Paralysis is an acute generalized systemic disease caused by a virus and characterized by inflammation of various parts of the central nervous system, but particularly by the damage to or destruction of the large motor cells in the spinal cord, with resultant paralysis of the voluntary muscles innervated by them.

HISTORY

Poliomyelitis is not a new disease, having been first definitely described in medical writings in 1784 by Underwood of London, though probable cases of it are found recorded in literature even back in ancient times. In 1835 John Padham reported 4 classical cases in 2-year-old children, occurring, in what would now be called a local summer epidemic, in rural England. In 1840 Jacob Heine of Connstatt published his first monograph, giving a clear clinical description of the disease and discussion of treatment, which he followed in 1860 by a second article pointing

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out its "spinal" character. The essential lesions of the central nervous system were gradually explored in the period between 1863–88 by Von Reinecker and Von Recklinghausen and others, and finally by Rissler in 1888, who described the changes in acute cases.

In this country the first epidemic was noted in Louisiana by George Colmer in 1841. The foundation of our knowledge of the epidemiology of polio was laid by Medin in 1890, and thus the disease is sometimes known in Europe as Heine-Medin's disease. Animal experimentation began to be fruitful in 1909 when monkeys were successfully innoculated by Landsteiner and Popper, Flexner and Lewis, and others, who thus demonstrated the disease was caused by a filterable virus.

Much careful and difficult investigation, clinical, epidemiological, experimental has been carried on in the 37 years since the discovery of the virus character of poliomyelitis and progress has been steady. Valuable information has been accumulated but as yet certain essential knowledge has not been won as to its transmission, its mode of invasion of the central nervous system, the tissue reactions of the host, and the development of an active or passive immunity. These are the real goals which science strives to reach, for far more important than the necessary and appealing rehabilitation of the paralytic are the elimination of the infection or the positive protection of the child from the disease in the first place.

EPIDEMIOLOGY

Infantile paralysis is world-wide in distribution but is more prevalent in temperate climates. It is a disease of summer and autumn, though occasional cases may occur

during any month of the year. The number of cases in a given region follows an irregular curve from year to year, reaching epidemic proportions at intervals. The disease, therefore, occurs in sporadic, endemic, and epidemic forms.

It is a disease of childhood, although it may occur at any age from infancy through maturity. In children the incidence is somewhat higher in boys than in girls, though in adults there is no such sex variation. Race and color are not significant. About 60 percent of cases are under 10 years, while over 80 percent are under 15 years.

While some epidemics have occurred in large metropolitan areas, when the total cases for the whole country are reviewed it can be seen that it is primarily a rural disease. This rural distribution plus the seasonal character points to a gastrointestinal portal or insect vector or both as the likely mode of transmission. Earlier suspicion of the upper respiratory route suggested by finding virus in nasal washings of patients and by monkey inoculation has been shifted by the work of Paul Trask and Sabin to the alimentary tract, for they found virus in quantity in stools, sewage, and trapped flies in epidemic areas. Healthy carriers of the virus with heavy infestation of stools are a well known feature and, as there are also a large number of abortive or unrecognized nonparalytic cases associated with actual paralytic cases in an epidemic, the virus must have a very much wider spread dissemination than realized from the recognized cases alone.

There are certainly great natural variations in the virulence of the virus from year to year and there are undoubtedly variations in the susceptibility of the individual host also. This is recognizable in the case of pregnancy, as the incidence is far higher proportionately in pregnant than nonpregnant women of the same age. Tonsillectomy also seems

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definitely to predispose to infection, and in such cases the bulbar type of the disease predominates with a very high mortality rate. Excessive exertion or fatigue appears to be a possible precipitating factor.

The incubation period varies from 7 to 21 days with 7 to 14 usually. It has been recently demonstrated, however, in one individual with known time of exposure that the virus appeared in the stool 6 days after contact, yet the patient did not develop the disease clinically until the twenty-fifth day. Second attacks are very, very rare but have been reported and can be induced in monkeys, showing that immunity from previous attack is not absolute.

However suggestive the above findings are, there is as yet no absolute proof of an intermediate host or animal pool, no known insect vector, no definite portal of entry or recognizable initial lesion nor, in fact, any typical lesion outside the central nervous system nor any essential precipitating or sensitizing factor.

The direction of preventive measures in an epidemic area are naturally under the local public health authorities. However, well children are warned against crowded places generally, especially indoors, swimming pools, travel, streams and water subject to pollution, overexertion, and tonsillectomies. Paralytic patients should be hospitalized if possible, at least screened, and bedding and excreta sterilized.

General sanitation of the community should be carefully checked, especially sewage disposal and the milk and water supply. Anti-insect measures are impracticable in rural areas, where most cases originate, but much can be done to protect food supplies in stores and homes from contamination. However, the healthy carrier and unrecognized non-paralytic patient make all reasonable preventive measures imperfect, and to rally public morale it should be remembered that while the mortality rate per 100 cases is high, the mortality rate per 100,000 population is always low. Most families and their children escape unscathed.

PATHOLOGY

To treat a disease properly it is essential to know the location and character of the tissue lesions it produces. The pathologists have well established that the essential lesions of poliomyelitis are all in the central nervous system even though the muscle weakness of the extremities is the obvious change noted by the patient. The virus has been recovered at one time or another from most of the tissues of the body, but no striking or permanent lesions seem to result from this systemic invasion.

The invasion of the central nervous system occurs as a relatively late manifestation and is now believed to occur by extension along neuronal pathways rather than by vascular, lymphatic, or other humoral methods. Certainly the work of Fairbrother and Hurst and more recent experiments of Howe and Bodian indicate that the virus is almost entirely neurotropic, infecting the neurons and not the neuroglia, and traveling from one part of the nervous system to another by passage along the axis cylinders. Sabin showed that in the primary bulbar type of the disease there were extensive neuronal lesions in the medulla with diminishing manifestations as one descended in the spinal cord. The exact reverse of this holds true in the spinal type of the disease. He feels that in the primary bulbar type the virus invades along the fifth, seventh, ninth, and tenth cranial nerves from the upper alimentary tract, while in the primary spinal type the invasion may well be along the visceral afferent fibers from the intestine by way of the posterior root ganglia. All recent

evidence points away from invasion through the nasal mucosa and the olfactory nerve as was once considered likely.

The virus, while it is generally neurotropic, has a very special affinity for the large motor cells of the anterior horn of the spinal cord. The destruction, partial or complete, which takes place in these cells represents the basic underlying pathologic process for this disease and was accurately described by Rissler in 1888 as a process of chromatolysis, lysis, coagulative necrosis, and neuronophagia. This has been again more lately stressed by Sabin and Ward who describe four stages as follows:

1. Chromatolysis and acidophilic intranuclear inclusions,
2. Acidophylic necrosis,
3. Invasion by polymorphonuclear leucocytes, and
4. Complete neuronophagia.

Sabin feels that up to and including stage three the process is reversible and the neuron may recover, as the damage is still partial, and that only at stage four is the destruction complete, and, therefore, irreversible and no recovery possible. This is the pathological basis for the extensive clinical recoveries from early paralysis so commonly seen.

The damage to or destruction of the anterior horn cells of the cord and motor nuclei of the brain stem give rise to temporary or permanent paralysis of the skeletal muscles by depriving them of their innervation. The muscles lose tone, become flaccid and undergo the secondary degenerative changes common to any denervation. Return to normal in the muscles occurs only if and when the motor neurones recover and reestablish innervation.

Infrequently when the attack of the virus is on the brain stem and it extends upward, lesions of the cerebrum are produced extensively and a spastic type of paralysis may result from destruction of the upper motor neurons. There is also a diffuse encephalitic type of lesion found in occasional cases in polio epidemics.

There is coincidental inflammation of the posterior root ganglia and other nerve elements and meningeal irritation with cellular and chemical changes in the spinal fluid, but such lesions are transitory and seem to have no permanent aftereffects.

SYMPTOMATOLOGY AND COURSE

The onset of infantile paralysis is very similar to that of many acute illnesses with fever, malaise, gastro-intestinal symptoms often associated with headache and occasionally nasi-pharyngeal irritation. Of gastro-intestinal symptoms, vomiting is the most common although diarrhea may occur.

In about 30 percent of the cases a bactrian and biphasic type of acute illness is recognized in which there are two distinct febrile episodes. In the first the patient has what appears to be an inconsequential illness which is nonspecific in type, associated with a variable amount of fever, usually not very high and lasting 24 to 36 hours. Following this the patient has a normal temperature for from 1 to 8 days, on the average of 2 to 3 days, and feels well or relatively well only to develop a more severe type of acute illness which is associated with evidence of involvement of the central nervous system.

However, the second febrile phase is more often the only one that is present or at least recognized. For practical purposes it may be considered that the 2 phases of the acute

illness are continuous in this type of onset with the intervening afebrile period omitted. When the second phase is reached the disease should be recognized clinically. The symptoms are those of a general illness, previously mentioned, to which are added symptoms indicating a pathologic process in the central nervous system. Headache may be very severe in adults, although this is not so likely in children. Muscle soreness appears in various areas but usually first in the neck and back where a feeling of stiffness may be described. Muscle spasm can be elicited particularly in the neck and back and hamstring muscles. Straight leg-raising becomes very limited as does forward flexion of the neck and back. On the second or third day of the febrile illness, the clinical signs referable to the central nervous system increase. Sensitivity and spasm are likely to be present in muscles other than those attached to the back. Irritability and apprehensiveness are common but, on the other hand if the process is accompanied by a large encephalitic component, drowsiness even approaching stupor may be present. It is not unusual to have a patient who seems very drowsy, who when aroused, becomes alert and apprehensive.

Paralysis is likely to occur on the second to fourth day. The paralysis appears first as a weakness of particular muscles which increases in degree and distribution with varying rapidity. It ordinarily reaches its maximum extent within 48 to 72 hours after it appears, although certain patients have continued fever and progressive paralysis for several days, even to fatal termination. The picture is one of weakness of flaccid type, together with spasm of the muscles which is elicited by stretching, but may sometimes be observed with the patient at rest. The positions adopted by the parts are those occasioned by the spasm and weakness. Once the fever has returned to normal for 24 hours it is unusual for further paralysis to occur. Ordinarily the temperature is normal within 4 to 7 days after the onset of the main febrile episode.

The patient does not like to be disturbed and is apprehensive of being handled. The spasm and sensitivity vary greatly in extent. The posterior neck, the erector spinae muscles, and the hamstrings are almost universally involved to a considerable degree. The muscle of respiration may be in marked spasm and it is not unusual to observe the respiratory exchange occurring with the thorax in a relative, inspiratory position. The paralysis is most variable both in degree and distribution. In a considerable percentage of mild cases none can be recognized clinically, whereas practically all of the skeletal muscles can be affected in severe cases. The paralysis is likely to be scattered in distribution although it tends to be regional. The individual muscles are affected in varying extent, from weakness which can barely be detected to complete paralysis without palpable contraction.

Reflexes are diminished in the involved areas although in the period of invasion there may be a transient hyperflexia.

In very rare instances, in which encephalitic involvement predominates, spastic paralysis may occur. The presence of sensitivity and spasm in conjunction with paralysis must be differentiated from spastic paralysis of the upper motor neurone type.

Death, if it does occur, is usually due to respiratory involvement, which may be of 2 general types: bulbar, in which the medullary centers are affected, and spinal respiratory type in which the muscles of respiration themselves are affected by paralysis. It is quite important to differentiate between the groups of respiratory involvement. The bulbar type is characterized by irregular respirations, difficulty in swallowing, and changes in the voice. In the spinal type

the muscles of respiration are affected so that the motions carrying out the respiratory mechanism are obviously weak or paralyzed, the accessory muscles of respiration are used, dilatation of the alae nasal occurs, the breathing is regular, but the respiratory exchange is obviously inadequate leading to cyanosis and anoxia. Cardiac failure may occur in the bulbar type particularly when overactivity of a delirious patient is allowed to occur.

Significant changes in peripheral sensation are unusual although occasionally hyperesthesia and even anesthesia may be found. Loss of control of the bladder with retention may be present for a few days at the onset, but full recovery of this function occurs rapidly.

It is well to emphasize that the clinical picture of the acute stage is most variable and that occasionally and particularly, in infants and in sporadic cases, paralysis may be the first and only symptom that is recognized.

Following the subsidence of the fever and the regression of the virus activity in the nervous system, the disease enters the recovery stage. The recovery stage can be divided clinically into 2 periods:

First—The subacute state when all danger of further paralysis is over, but during which the effects of the general inflammatory reaction in the nervous system are still manifest as shown by nervousness, irritability, tenderness, hyperesthesia, stuffiness, and spasm in addition to the essential muscle weakness or paralysis. This stage may last from a few days to as long as 2 months with gradual fading out of the nonmotor byproducts.

Second or convalescent stage is reached when purely motor weakness is all that remains. The length of the convalescent stage is still more uncertain and variable. The older estimate of 3 to 5 years during which improvement of motor

function could be anticipated with recovery of damaged but not destroyed motor nerve cells has been greatly reduced. Recent observations indicate that the convalescent stage lies somewhere between 9 and 18 months at most, and the residual stage begins for those in whom paralysis has persisted beyond 18 months. Even the residual stage is not without hope, however, as it is at this time that reconstructive surgery can accomplish much for the patient. All during the recovery period spontaneous return of power is to be expected and proper measures to facilitate the natural recovery are of great importance and value.

An extreme variability between individual cases, even in the same epidemic, is a feature of the onset, symptoms, severity, course, and aftereffects of this disease.

DIFFERENTIAL DIAGNOSIS

Acute poliomyelitis is easy of early clinical detection during the full-blown epidemics and can often be diagnosed in the preparalytic stage and in abortive forms at such times. It is only when definite paralysis has occurred, however, that early epidemic or occasional cases can be diagnosed. Diagnosis in doubtful cases can be checked by lumbar puncture showing a slight increase of pressure, and a clear fluid with moderately increased cell count of mononuclear character.

History of injury is sometimes misleading, but no other acute infectious process really gives one the picture of such a flaccid type of weakness. The meningitides, coccal and tubercular, transverse myelitis, encephalitis, hysteria, the pseudo-paralysis of congenital lues and even sub-acute osteomyelitis must be excluded in each case depending on age, history, accompanying sensory changes, and hyperesthesia.

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The best early clinical sign of an impending polio in an ailing child in late summer or early autumn is inability to bend neck far forward. If this symptom is absent no danger to the child is imminent in the next 24 hours.

In the residual stage one has less difficulty in diagnosis if reliable history is available, as other illnesses combining flaccid weakness without sensory loss are rare and have a very different background.

THE PROGNOSIS IN POLIOMYELITIS

Prognosis as to Life

The mortality rate has varied greatly in different epidemics and in different localities. In New York City and State in 1916 it was 25.2 percent. In Sydney, Australia, in 1937 it was less than 1 percent. In Manitoba in 1941 the death rate was but 1.8 percent. The average mortality in recent epidemics in this country has been 7 to 8 percent. In general, the death rate in recent years has been lower than in earlier epidemics. This is probably due to a more general recognition and recording of the abortive cases of paralysis. It should be recognized, also, that the toxicity of the virus may vary in different epidemics and in different localities, for the mortality is higher in widespread epidemics such as in 1916. Death occurs from respiratory failure or from a pneumonia which may arise not only during the acute phase of the disease but even many weeks later. The highest mortality, recorded as 42 to 80 percent, occurs in those cases which have bulbar type paralysis. The prognosis is worse in adolescents and in adults than in children under 10 years of age.

Prognosis as to Recovery From Paralysis

The possibility of the recovery of any paralyzed muscle is absolutely dependent upon the condition of the motor cells which innervate the muscle. Cells which have been destroyed by the virus of this disease can never be reproduced. Cells which have been damaged but not destroyed may recover their physiological function. If all the neurons which innervate a particular muscle have been destroyed, that muscle will be completely and permanently paralyzed. If some of the cells have been killed and some survive there will be a partial recovery of the power of the muscle, the degree, naturally, being dependent upon the relative number of the motor cells which recover. If all of the cells remain vital after the destructive phase of the disease has run its course, there is the possibility of a return of normal power in the muscle.

Spontaneous improvement in the over-all picture begins in most cases within a few days and in practically all cases within a few weeks.

The prognosis is worse in severe attacks of paralysis and in those involving all muscles below a certain level, although there are many exceptions to this general rule. A slow progress of paralysis with exacerbations and involvement of new muscles over a period of days and excessive and long-persisting tenderness are unfavorable factors in the prognosis.

The bulbar cases either die or recover without paralysis of the peripheral muscles.

At the beginning of the stage of convalescence or recovery from poliomyelitis the physician cannot know the pathological conditions present in the motor centers in the spinal cord and can have no reasonable opinion as to the ultimate prog-

nosis. But such an opinion can be given at the end of 3 months, and, at times, even before that.

Muscles that show early and rapidly developing return of strength will probably make a full recovery. Those which have but moderate or little strength at the end of this period will probably never make complete recovery. Muscles which are completely paralyzed at the end of 3 months will probably always remain so. In other words, at the end of 3 months the spinal motor cells have or have not recovered their physiological activity and no further change in them may be expected. This does not mean that muscle fibers to which active motor innervation has been restored may not continue to grow in strength for an indefinite time. To this end treatment during the long convalescent period is definitely directed.

The prognosis, therefore, while primarily dependent upon the irreversible or reversible damage to the neurons may be modified and made less favorable by the absence of proper treatment during the period of recovery. The factors which favorably or unfavorably influence the recovery of the muscles will be discussed under the subject of "*Treatment*".

The *percentage* of recovery depends on the factors enumerated above and varies with the nature of the epidemic. Many statistics are available from many parts of the world since the time of Wickman (1911) to the present day. A survey of these leads to the following observations:

1. The abortive, or nonparalytic, type constitutes at least 20 percent of the total cases reported. This percentage has been much higher in instances where more careful diagnostic search has been made for these cases. Inasmuch as they never have been paralyzed, they should be excluded from statistics of complete or partial recovery from definite paralysis.
2. Spontaneous complete recovery from paralysis has occurred in from 35 to 60 percent. Many statistics do not enumerate the number of abortive cases and must be excluded from consideration. When all cases, including the abortive cases, are considered, complete recovery has occurred in from 55 to 80 percent.
3. About 2 percent remain completely disabled.
4. Ten to 20 percent require the use of braces or aid from reconstructive surgery.
5. The remainder have no significant handicap.

On the whole, the prognosis in poliomyelitis is favorable; and one may agree with one author who states that "with good care 75 to 85 percent of the cases will show marked improvement or complete recovery."

The Prognosis of Ultimate Functional Use of an Affected Extremity

This depends on the location and the extent of the residual paralysis and upon orthopedic treatment in the final stage of paralysis. Parents often wish to know whether the child will be able to walk, or have a bad limp, or have a shrunken and short leg, or be able to use his hands and his arms. The physician with a knowledge of the anatomy and function of muscles will be able to give a fairly accurate reply to these questions. Weakness or paralysis of some muscles produces more alteration of gait than paralysis of other muscles. Paralysis of the muscles of the hand and forearm is a more serious handicap than paralysis of the shoulder. Function

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of flexors of the elbow is more important than that of the extensors. Unparalyzed gluteal muscles will enable the child to walk without braces or crutches. The shortening of a lower extremity depends, with some exception, upon the extent of the paralysis and the age at which it has occurred. The orthopedic surgeon can visualize the improvement in function which can be obtained by operative procedures.

TREATMENT IN THE ACUTE PHASE

Treatment of the acute phase of anterior poliomyelitis is primarily the responsibility of the pediatrician or family doctor. However, the orthopedic surgeon has been charged with, and should be prepared to accept the responsibility for, the preservation of function and the prevention of deformities in the spine and extremities of these patients.

Loss of function during or following an attack of acute anterior poliomyelitis may result from prolonged muscle spasm, deformity, or muscle paralysis. It would seem obvious, therefore, that the best results can be obtained if the orthopedic surgeon works in close harmony with the family physician or pediatrician from the day that the diagnosis of acute poliomyelitis is made.

Acute anterior poliomyelitis may be subdivided into:

1. Preparalytic
2. Abortive and
3. Paralytic phases.

Preparalytic

When the diagnosis is made early after the onset of illness at a time when no paralysis has appeared or can be

demonstrated, the polio patient should be treated by bed rest with care given to position in bed, sedation, the avoidance of fatigue or of excessive handling such as might be required by transportation over long distances in order to reach a hospital.

Positioning in bed is preferably accomplished by the use of a firm mattress with boards between it and the springs. A foot board serves the dual purpose of keeping the bed clothing from pressing down against the feet and affords a smooth surface against which the feet may be braced in a position of 90° dorsiflexion and neutral with respect to rotation.

If the patient is markedly toxic and unable to retain fluids by mouth, the fluid balance of the body must be maintained by intravenous feedings. The concensus of opinion has ruled against the use of convalescent or adult serum as a specific agent. Blood plasm or whole blood, however, may be of value to restore plasm proteins or for the prompt correction of anemia should this be present.

During this stage, which may last 3 to 5 days after the onset of the disease, there may be manifestations of involvement of the sympathetic nervous system as well as of anterior horn cells. Patients with these symptoms are restless and apprehensive. Sedation by means of barbiturates and, in the rare cases in which there is an appreciable amount of pain, morphine in doses suitable to the age of the patient should be given. Heat may be soothing and, unless the patient's own temperature exceeds 101°, moist but not wet woolen packs should be applied over the spine and to each extremity in which there is beginning weakness, muscle soreness, or a change in muscle tone. These packs should not be kept on continuously but should be used for 1 to 2 hours morning and afternoon. In order to avoid, insofar

as possible, handling of the patient, these hot packs are not wrapped around but are simply laid upon the involved extremity or the spine. This has been designated as "prone packing."

Abortive

The abortive case of poliomyelitis is that one in which the early symptoms of the disease are definite and may be confirmed by spinal puncture but where paralysis is not manifested. Most of these cases are never recognized. These patients need no special care beyond continued bed rest and sedation, though they should be examined for spasm or hypertonicity of the muscles of the back. Tightness or spasm of the spinal and the hamstring muscles should be treated by application of heat, either dry or wet, once or twice each day. Later spine flexion exercises should be instituted to relieve contracture or shortening of muscles until normal flexibility of the spine has been restored. This restoration of length of shortened or spastic muscles is essential regardless of whether or not there is demonstrable paralysis.

Paralytic

With the onset of actual paralysis the program of bed rest, sedation, and protection by bed positioning is continued. Muscle examinations should be made but limited to the most superficial testing in order to avoid fatigue. The foot board is now of greatest value. If correctly used it will maintain dorsiflexion of the foot and prevent shortening of the gastrocnemius or soleus muscles. Occasionally it may be advisable to use splints of wire or plaster shells to support and maintain the physiological position of muscles which

have been partially paralyzed and might be weakened still further if permitted to become stretched by malpositioning.

With the first onset of paralysis the attending physician must be constantly on the lookout for signs of bulbar involvement. The purely bulbar manifestations are less common, however, than are those in which there is mixed paralysis with both bulbar and spinal manifestations. Difficulty in swallowing may precede difficulty in breathing. Artificial respiration may have to be administered while a respirator is being located or prepared.

The use of a respirator on patients who have bulbar involvement has been urged by certain clinicians and condemned by others. Those who are most experienced in the handling of poliomyelitis patients during the early phase of paralysis know that the pure bulbar type of the disease, or the type in which the bulbar manifestations predominate and the spinal involvement is moderate or minimal, offer the best opportunity for complete recovery if life can be maintained through the acute phase of the disease. For this reason it would seem to be essential that every possible effort be made to keep such patients alive during this early paralytic phase. If a respirator is available, it should be used when respiratory distress, fatigue, or cyanosis becomes marked. The patient should be taught to breathe with the respirator instead of struggling against it. If the patient has extensive evidence of bulbar involvement with difficulty in swallowing, the foot of the respirator must be elevated about 10 inches to provide postural drainage and to make aspiration of saliva and other secretions less likely. Mouth feeding is impossible and stomach tube dangerous, so intravenous feeding is essential. Suction to clear the upper respiratory tract is important. Penicillin to prevent pulmonary complications is indicated. The nurses and doctor must constantly reassure the patient

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and also the family insofar as it is possible to do so with honesty. One can always be sure, if the patient survives, that there is to be some measure of improvement.

Heat is recommended for all patients during the acute phase of the disease. Both radiant heat and warm, moist packs have been found of value. There is no convincing evidence of the superiority of either method over the other. Prolonged heat of any kind, however, not only brings about dilatation of the cutaneous and other peripheral capillary blood vessels but may produce passive congestion in muscles which are not being moved or exercised and thus increase rather than reduce muscle stiffness, fibrosis, and shortening. Heat should be applied intermittently and for not more than 1 to 2 hours daily.

Physical therapy during the acute paralytic phase of acute anterior poliomyelitis must be carefully supervised and restricted in its application. Heat therapy should be administered under the direction of a physical therapist or nurse who has had experience and training in the correct handling of patients suffering from this disease. Passive or active movements may be used with the purpose of preventing contractures and of relaxing muscle tensions, but must never be carried to the point of producing pain. Circulation within muscles may be improved by this early but very gentle passive, or when muscle power is still present, active movement.

Thus, through carefully positioning the patient in bed with the knees relaxed in a few degrees of flexion, the feet held at 90° dorsiflexion, the arms abducted slightly from the sides and in slight external rotation at the shoulder, and the back supported by a firm bed, and with the additional factors of heat and early movement of extremities most contractures and deformities can be prevented.

During the early paralytic stage it is imperative that there be adequate fluid intake and adequate fluid elimination. The care of the bowel as well as the bladder must not be neglected. Enema may be necessary if there is marked involvement of abdominal muscles. The patient who is being treated by means of hot packs or any other type of heat will perspire profusely. This requires restoration of fluid and of sodium chloride and vitamin C. Children appear to need these supplements or replacements in as large amounts as do adults. Each patient should be given one 7½ grain capsule of sodium chloride three times daily, and vitamin C, 100 mg., morning and evening each day. Because of the involvement of nerve tissues, thiamin hydrochloride three times each day, although its therapeutic value is theoretical, is recommended.

The emotional and psychological manifestations in poliomyelitis have not been adequately studied or evaluated. If the onset of paralysis is sudden and severe, the patient may become frightened and apprehensive. This fear and nervousness is more marked in the older child or adult than in young children. These older patients are in a position to appreciate more fully the catastrophe which has befallen them and to realize more adequately the problems which a severe paralysis will create insofar as life in the future is concerned. The patient must be "understood" and reassured. This does not mean that false prognoses should be given. The patient, however, must be helped to begin to face the realities of his condition. Without this psychological adjustment all other effort to help will be wasted.

It is essential that the doctor devote adequate time to educating the family group. The mother and father and other members of the immediate family who are old enough to understand and cooperate must be made to realize that they have a most important part to play in the recovery of

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the patient. They should be taught to adopt an attitude of calm assurance, to avoid anything approaching hysteria, emotional outbursts, or excessive parental concern.

TREATMENT IN THE RECOVERY STAGE

Subacute Recovery Stage

As the transition of the disease from the acute paralytic stage to the early subacute recovery stage is a gradual and almost imperceptible one, evidenced chiefly at first by regression of fever and absence of new paralysis, so the therapeutic measures also do not abruptly change. Respirator cases have to continue with their mechanical breathing for days and weeks often before sufficient recovery of muscle control and power makes it safe to remove them from the respirators. This must be done gradually for short intervals only—a slow weaning process with concomitant building-up of muscle strength within the patient. This is a dramatic example perhaps, but illustrates the principle to be followed with their less dangerously paralyzed fellow-sufferers also. Bed rest with careful positioning to afford protection and relaxation to affected parts must continue, with perhaps substitution of splints or plaster shell casts on affected limbs to afford a chance for the more rapidly increasing activity of unaffected parts.

As early as possible in this stage it is desirable to get a muscle check so that one can have a basic estimate of the extent of the disease and the degree of damage done to start with. Muscle checking is a difficult technique, and when done on a weak and hypersensitive patient requires gentleness, tact, patience, and a trained touch. It must be realized that such an early check is complicated by the general debility

of the patient. Fear, as well as hypersensitivity, make the patient's cooperation uncertain, so that only a rough estimate of power is obtainable. As a rule completely paralyzed muscles can be readily charted by their tonelessness which can be appreciated even by gentle palpation, and the unaffected strong muscles can also be fairly readily identified as such by touch. The muscles with partial paralysis are more difficult to evaluate at this early stage, as the patient's condition makes handling and positioning for testing often impossible, and for real accuracy one must wait till all soreness has departed. Often the examination must be discontinued to prevent overfatigue and only a few muscles can be tried out at any one time. A week or more may be required in a bad case before a full muscle chart can be completed.

As the anxiety and irritability of the patient subside with the regression of virus activity, the sedation can be slowly reduced. The actual pain varies greatly in cases, from complete absence of discomfort to exquisite hyperesthesia. Where pain is a feature it must be mitigated by opiates with the knowledge that it will eventually disappear completely.

Heat, as used in the acute paralytic stage is continued. Radiant heat, packs, or at this stage, warm tubs with the patient lifted in a sheet are helpful for prolonged or severe tenderness.

Exercise may be begun tentatively as pain subsides and increased only as tolerated readily by the patient without evidence of fatigue. Massage is not used at this stage because of sensitivity of the muscle masses, but passive movement of joints in paralyzed extremities may be started over a comfortable arc of motion. Motion begun early and gently performed can prevent stiffening of joints, and it is especially beneficial where splinting is used to insure against restrictive contracture of strong muscles, opposed only by weakened or

paralytic ones. Passive movement can be slowly and steadily increased just as exercise. The patient's reaction should be the guide, but it is safer to err on the conservative side and thus avoid overfatigue, pain, and overstretching. We must court the recovery of the damaged nerve cell by not imposing reflex or other avoidable stimulation to it. We must recall that at this time the central nervous system as a whole is still in an inflamed and irritable state, and we must strive to spare it by disturbing the patient and his sensitive body only when necessary and for as long as readily tolerated. Protection and comfort are still our watchword at this time.

As a rule this stage lasts but a short period and soon passes over to the painless, final convalescent stage, but where it is prolonged the general irritability and fatiguability of the patient prevent attempts to adjust them psychologically to their new problems. They are still too sick to be much interested and their chief psychological need is still reassurance and comforting, both physical and mental.

Convalescent Stage

This is reached in a couple of days to a couple of months from onset with the subsidence of the general inflammatory phenomena in the central nervous system and is the period when return of muscle power is awaited. This depends on the recovery of the lesions in the motor cells of cord and brain stem nuclei which have been damaged but not killed. Just as we have no known way to arrest the attack, we have no means to hasten this nerve repair. However, much can be done to help the patient's ultimate recovery by maintaining the muscles, bones, and joints in as good physiological condition as possible. An automobile will not start with run-down battery, but it also won't run well later if allowed

to deteriorate in motor and bearings while the battery is being recharged. We cannot be sure of recovering a fully recharged battery in polio, but we can do a lot to keep the rest of the machinery in good running order. That analogy illustrates the object of our endeavors in this stage of the disease.

This is the period when physiotherapy reaches its maximum usefulness, for massage and educative exercises are of the utmost importance in restoring weakened muscles to their utmost effectiveness. With neurological recovery the muscles return to tone and power rapidly if they have a proper combination of rest, support, and graduated use together with the measures of heat and massage to stimulate local circulation.

It is at this time that care in an orthopedic children's hospital is most beneficial, for by now the patient has recovered from the systemic effects of the disease in which general medical or pediatric supervision is so important and has become a purely orthopedic problem requiring the special skills and facilities obtainable in such institutions. Travel now is no added strain, so transfer from general hospital or home to a children's hospital is no risk. Quarantine regulations do not interfere, and in severe cases the emergency is over and long-range planning for convalescence is necessary in all cases of considerable paralysis. The mild case with quick recovery of good power passes out of our picture here and needs only occasional follow-up check, so we will confine our remarks to the important minority of cases who have considerable persistent paralysis at this time.

Hospitalization is also extremely valuable in the general reeducation of the patient who is taken out of the individual sick room where fear and self-pity bloom so quickly and placed in a company of his peers, all of whom are making the

same struggle to recover and adjust. He is no longer a blighted invalid among a host of pitying people, but soon becomes a comrade in arms in the adventure of recovery or of remaking his life along new lines. Adults as well as children soon catch a new spirit and hope when this change is made. The doctors, nurses, physiotherapists, occupational therapists, and teachers all have their active part to play in this great process of psychological readjustment and team play to give the institution its essential esprit de corps and healthy atmosphere of cure.

General rest becomes less important gradually, but local protection of the affected parts is still in order. Bed rest is reserved for the severely incapacitated and, as far as possible, the partially paralyzed patient is gotten up and about in graduated doses and with splinting and other protection to weakened parts against deformity, overfatigue, and overstretching. This is modified as frequently as the recovery of muscle power warrants.

Physiotherapy is also modified frequently to suit the individual need, but basic reliance is placed on heat, massage, and muscle training.

There should be careful muscle checks at the start and at monthly intervals of all paralyzed or weakened muscles, both to guide treatment and foster patient's interest and morale.

Under-water exercise in tubs or pools is useful in this stage and serves to give patient confidence as well as exercise. Later gait training is important. The details of all the useful variations of physiotherapy are too numerous even to mention.

Occupational therapy, regular school sessions, and recreational facilities can only be mentioned in brief, but are most helpful adjuncts in returning even severe cases to a normal manner of living.

Braces are often required as temporary aids to recovering weakened muscles and, in the lower extremities, are used as substitute supports to allow earlier ambulation and to prevent deformity, while in the upper extremity arm splints and hand opponens cuffs are the oftenest used for support. The serious trunk, back, and abdominal paralyses are best treated during the convalescent stage in bed recumbency, as these muscles are so hard to protect when patient is up, and it is so important that they regain every ounce of possible power.

Not only must the weakened paralytic muscles have careful attention, but the strong and often unopposed strong muscles must be supervised to prevent contractures and distortions occasioned by their imbalanced strength. This is particularly true of the trunk muscles, and often stretching and corrections of strong groups must be a part of the physiotherapy regime.

Atrophy of paralyzed muscles is present early and, as a result of the lessened circulation so produced, there may be changes in the growth rate of bone in a paralytic extremity. This begins early and, though its progress is slow, definite note should be taken of the bone growth at the start and end of the convalescent period. This disability is not subject to treatment, but should be observed and recorded during the convalescent period.

As this brief outline can only indicate but not elaborate upon, the convalescent period is the one in which more can be done actively for the patient than at any other time in the disease. We have but touched on the various types and kinds of treatment required in the seriously paralyzed case. Fortunately, the majority of patients pass through it more or less rapidly and reenter active life as normal. For those few whose damage is permanent after 18 months, there remains the residual stage.

TREATMENT DURING THE RESIDUAL STAGE OF PARALYSIS

When this final stage of paralysis has been reached, no further spontaneous improvement in muscle power may be expected. This does not deny the fact that any individual is able by specialized exercises to increase the strength of muscles for an indefinite time. The patient at this time has a definite weakness (partial paralysis) or a complete paralysis of one or more skeletal muscles. If he has had sufficient treatment during the preceding stage of recovery he should have no preventable deformities. It may be stated frankly that some deformities which are due to marked muscle imbalance are inevitable and that they become more evident and more severe after the patient has become ambulatory.

The object of all treatment during this stage of infantile paralysis is to reduce as far as possible the functional handicaps which the patient possesses as the result of the paralysis.

If any partially paralyzed muscle has been increasing in strength by specialized exercises, these exercises should be continued until it is evident that the limit of power has been attained. It is futile to try to exercise muscles that are completely paralyzed or are so feeble that they have no functional value. It is futile and wasteful to continue with expensive physical therapy under these conditions. If the use of heat and massage and corrective exercise is at times indicated for some particular and definite reason these forms of treatment can be carried out in the patient's home.

Existing deformities which interfere with the function of the extremities should be corrected by manipulative or operative procedures.

Continued attention must be given to the prevention of deformities during the ambulatory stage. This may require

the use of braces and appliances, which may also serve the additional purpose of enabling the patient to walk when otherwise he would be unable to do so and of preventing overwork and overtire of weak muscles.

The largest and the most fruitful field of treatment of residual paralysis consists of the many orthopedic operations which have been devised to secure the permanent correction of deformities and to improve the function of the extremities. As this is entirely a part of orthopedic surgery, it will not be discussed here.

Physical education is desirable to secure improvement in gait and to make the best use possible of the muscle power which remains. Games, sports, manual training, and eventually specialized vocational training to fit the crippled child for an independent and a useful life are of the utmost value. These things in themselves contribute immensely to the maintenance of a normal mental and psychological attitude toward life.

"Sheltered workshops," or similar economic stepping-stones to aid severe cases in their self-support are a real need in many communities.

SOCIAL ECONOMIC CONSIDERATIONS

As can be seen from the foregoing section, the treatment of a severe polio case is a long, intricate, and costly affair. It can be economically sound if wisely supervised, for it is possible after the first few months to limit most of the effort to the few more seriously disabled cases. Recovery in the majority of cases is early and spontaneously completed in a few weeks or a couple of months, and such cases need not be carried on hospital rolls, but can be supervised subsequently as out-patients at relatively infrequent intervals. There is

also a large group who, though moderately affected, can be cared for at home after the victims have been trained in principles of therapy in hospital, and their families coached in the necessary further treatments required for the individual cases.

Finally, much saving can be made by combatting the natural human tendency to prolong treatment beyond the reasonable recovery period in the vain hope that somehow, somewhere, nerves will be conjured up. This fallacy leads to ultimate disappointment, trial of other inadvisable treatments, waste of time, delay of final adjustment, postponement of reconstructive surgery, in addition to a huge economic waste.

It should always be remembered that cases of poliomyelitis are not cured, that they recover, and we can but assist in that recovery.

U. S. GOVERNMENT PRINTING OFFICE: 1940

D19

Infantile Paralysis

(Poliomyelitis)

General Information for Those Who Have to Deal with This Disease

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Issued by the IOWA STATE DEPARTMENT OF HEALTH
Des Moines, Iowa

Question: What is infantile paralysis?

Answer: Infantile Paralysis, technically known as poliomyelitis, is an acute infectious and communicable disease affecting the nervous system and caused by a non-visible germ or virus.

Q. What are the early symptoms and signs of infantile paralysis?

A. Beginning symptoms include fever, tired feeling, vomiting, diarrhea and sore throat. Later complaints are of headache with pain and stiffness in the neck or back. Early recognition of the disease is aided by examination of the spinal fluid.

Q. What is the first thing to do in illness of this type?

A. Call your attending physician without delay.

Q. What length of time elapses between the day of exposure and the development of symptoms?

A. The length of time, called the incubation period, usually varies from three to ten days.

Q. When does paralysis occur?

A. There are, as a rule, two or three days of early symptoms; paralysis usually develops about the third or fourth day.

Q. Is infantile paralysis dangerous to life?

A. It is not a highly fatal disease. About 75 percent of the victims recover, many without permanent paralysis. The fatality rate varies from five percent to thirty percent in different epidemics.

Q. Is there a seasonal variation in the prevalence of the disease?

A. Yes. The late summer and early fall months show the largest number of reported cases.

Q. Is the average annual number of cases constant?

A. No. The number of cases varies from year to year.

Q. Is it possible to predict when a large increase will occur?

A. At periods of from three to six years, there is usually a definite increase in prevalence of the disease. (See table on back of this leaflet.)

Q. Are there different types of infantile paralysis?

A. Yes. The forms recognized are abortive, non-paralytic and paralytic cases, the last named depending largely upon the location in the spinal cord or brain at which the disease is present.

Q. Is the common name, "Infantile Paralysis", entirely correct?

A. No. The disease is not confined to infants and does not always result in paralysis.

Q. When paralysis occurs, is it always permanent?

A. No, paralysis is sometimes only temporary.

Q. What results may be expected?

A. Severe cases may result in permanent paralysis, while in those less severe the paralysis may gradually recede, followed by complete or almost complete recovery.

Q. Who may be attacked?

A. The majority of cases occur in children under 10 years of age, but persons of any age may have the disease?

Q. Does everyone who is exposed to infection contract the disease?

A. No. Only susceptible persons, chiefly children and young adults, are likely to acquire illness.

Q. Is there a serum or preparation which will prevent a person from developing the disease?

A. No. There is no process known with certainty to achieve this result.

Q. Is there a serum for treatment?

A. Convalescent serum obtained from persons who have recovered from infantile paralysis, may be used in the early stage preceding paralysis. Best results may be expected when the serum is given early and in adequate amount.

Q. May persons who are not sick with the disease be "carriers"?

A. Yes.

Q. What is essential in the treatment of a patient?

A. Absolute rest during the acute stage is recommended by physicians who specialize in this disease. Active movements should be prohibited and passive movement avoided to the greatest possible extent. These restrictions should be observed until a week after the temperature has returned to normal and until all pain and soreness have gone out of the muscles. Active massage and passive movements during the early stages of the disease have no value and may be productive of much harm.

Q. Is infantile paralysis a reportable disease?

A. Yes, to local health officials and to the Iowa State Department of Health.

Q. Will the patient be quarantined?

A. Yes, for a minimum period of 21 days from onset of illness.

Q. Is the house placarded?

A. Yes.

Q. Are other children in the family to be kept out of school?

A. Yes, they must stay on their own premises during the period of quarantine.

Q. What can be done to avoid infection?

A. Keep children away from crowds and limit their opportunities for human contact as much as possible while the

disease is prevalent. Care should be taken lest resistance be lowered by fatigue, undue exertion or too strenuous exercise.

INFANTILE PARALYSIS IN IOWA.

Cases and deaths as recorded by the Iowa State Department of Health during the 31 year period 1910-1940.

Year	Number of Reported Cases	Number of Deaths
1910	565	146
1911	70	40
1912	77	38
1913	49	28
1914	19	16
1915	19	17
1916	256	28
1917	16	32
1918	175	16
1919	13	1
1920	211	112
1921	170	131
1922	21	21
1923	208	7
1924	65	12
1925	176	39
1926	19	12
1927	109	28
1928	37	16
1929	76	22
1930	222	32
1931	167	28
1932	51	17
1933	45	15
1934	37	7
1935	65	6
1936	76	13
1937	241	40
1938	40	10
1939	197	30
1940	929	64
Totals	4345	1011

Q. Where may information be obtained concerning after care of paralyzed cases?

A. From the Iowa State Department of Health, Des Moines, Iowa.

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INFANTILE PARALYSIS
(POLIOMYELITIS)

Although there may be no cases of infantile paralysis in a community, mothers and fathers are concerned about this disease and want to know whether there is anything they can do to keep their children safe from it.

Unfortunately, there is no specific means of protection against infantile paralysis, and the manner in which the virus causing it is spread is not conclusively known. But several things can be done to reduce the chances of exposure to it and to prevent or lessen deformity in cases in which paralysis occurs. To be as safe as possible—

LOOK WITH SUSPICION

—upon even minor upsets in your children—for example, vomiting, constipation or diarrhea, or a slight cold—especially during the summer and early fall when outbreaks of infantile paralysis most often occur. A child coming down with infantile paralysis may become drowsy or restless, feverish, irritable. He doesn't want to be moved. He may have a sore, stiff neck and spine, and pains in the back, arms, and legs.

CALL YOUR PHYSICIAN

—*without delay* if a child shows even slight signs of illness when cases of infantile paralysis appear in the community. Keep the child by himself until the doctor comes. He may not have infantile paralysis, but let the doctor decide. Not all children who catch the disease become paralyzed. For those who do, early treatment under a skilled physician,

nurse, and physical therapist, and proper controlled rest and motion of the affected muscles will help to speed recovery and may prevent or lessen crippling aftereffects.

AVOID "DANGER ZONES"

—by keeping children away from movies, parties, crowded trains, public beaches, and swimming pools, until the outbreak is over. Playing near streams, lakes, or ditches into which sewage drains may be dangerous, since infantile paralysis virus, as well as the germs of other diseases, have been found in sewage-contaminated water.

DO THESE SIMPLE THINGS

—which may help to protect your children from the danger of contracting infantile paralysis.

Postpone, if possible, the removal of tonsils, the extraction of teeth, or other operations in or about the nose, throat, or mouth during an epidemic. See that children avoid chilling and overfatigue, and pay careful attention to personal cleanliness, especially handwashing. Keep the home as clean as possible. Use plenty of soap and water, fight flies, mice, rats, and other vermin and protect food from flies.

Be guided by your physician and the local health officials if infantile paralysis strikes in your community. Services for patients are made available through local chapters of The National Foundation for Infantile Paralysis.

This leaflet was prepared with the cooperation and advice of
The National Foundation for Infantile Paralysis.

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BEekman 3-0500

Bulletin

SAVE THIS
You'll want it if infantile paralysis strikes.

When Polio Strikes . . . Helpful Hints for Everyone

June through September is the season when infantile paralysis generally is on the upswing in the United States. The National Foundation for Infantile Paralysis has compiled the following suggestions which will be helpful to residents of areas where poliomyelitis is on the march.

1. During an outbreak of infantile paralysis be alert to any early signs of illness or changes in normal state of health, especially in children. Do not assume that a stomach upset with vomiting, constipation, diarrhea, severe headache or signs of a cold and fever are of no importance. These may be among the first symptoms of infantile paralysis. All children and adults sick with unexplained fever should be put to bed and isolated pending medical diagnosis.

2. Don't delay calling a physician. Expert medical care given early may prevent many of the crippling deformities. Proper care from the onset may mean the difference between a life of crippling and good recovery.

3. Today there is no known prevention or protection against infantile paralysis. All that can be done is to provide the best possible care. Your doctor, your health officer and your local Chapter of The National Foundation for Infantile Paralysis can and will do everything in their power to see to it that your community is ready to meet an epidemic.

4. Observe these simple precautions:

(a) Avoid overtiring and extreme fatigue from strenuous exercise.
(b) Avoid sudden chilling such as would come from a plunge into extremely cold water on a very hot day.
(c) Pay careful attention to personal cleanliness, such as thorough hand washing before eating. Hygienic habits should always be observed.
(d) If possible avoid tonsil and adenoid operations during epidemics. Careful study has shown that such operations, when done during an epidemic, tend to increase the danger of contracting infantile paralysis in its most serious form.
(e) Use the purest milk and water you can. Keep flies away from food. While the exact means of spread of the disease is not known, contaminated water and milk are always dangerous and flies have repeatedly been shown to carry the infantile paralysis virus.
(f) Do not swim in polluted water.
(g) Maintain community sanitation at a high level at all times.
(h) Avoid all unnecessary contact with persons with any illness suspicious of infantile paralysis.

5. Don't become hysterical if cases do occur in your neighborhood. While infantile paralysis is communicable or catching during any outbreak, there are many who have such a slight infection that there are few or no symptoms. This large number of unrecognized infections is one of the reasons there is no practical way of preventing the spread of the disease. But it is also reassuring to know that, of the many persons who become infected, few develop serious illness and that, with good care, the majority who are stricken will make a satisfactory recovery. Remember that although this is a frightful disease, needless fear and panic only cause more trouble.

6. Attempts to stop the spread of the virus by closing all places where people congregate have been uniformly unsuccessful. The resulting disturbance to community life is a disadvantage. Today there is no way by which the spread of infantile paralysis can be completely stopped.

7. There is no known cure for infantile paralysis. Good medical care will prevent or correct some deformities. But in about every fourth or fifth case there will be permanent paralysis that cannot be overcome. Do not believe those who for one reason or another promise to cure these cases. Be guided by sound medical advice if polio does strike in your family.

8. County Chapters of The National Foundation for Infantile Paralysis are prepared to work with health officers, doctors, nurses, physical therapists, hospitals and patients. These Chapters stand ready to use their funds to assist the entire community. Know your Chapter—ask its help if needed—and volunteer to help your Chapter so that it will be able to render the necessary services.

D19

Doctor . . . What can I *do* . . . ?

Facts About

INFANTILE PARALYSIS

A Publication of

THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS, INC.

120 Broadway, New York 5, N. Y.

No. 34A

Foreword

IN THE one brief year since the first edition of "Facts About Infantile Paralysis" was published, many changes have taken place. While today there is no certain method of prevention or cure, great advances have been made in the method of treatment.

The epidemics of 1941 created a tremendous demand for splints and frames to rest paralyzed muscles. In the light of the knowledge of that year immobilization by splints and frames was the treatment of choice. But now we have the method of treatment introduced by Miss Elizabeth Kenny, the Australian nurse, in which early physical therapy replaces splinting.

And so in the light of new developments this revision of the pamphlet is offered to the public. It presents a summary of information available from various scientific sources as a precaution against errors of judgment and ignorance which may result in unnecessary suffering and crippling.

Our first line of defense against an invasion of infantile paralysis is KNOWLEDGE of its presence, its cause, its means of spread and what can be done in the way of treatment. New facts have been learned and new methods have been developed, but much still remains to be done before infantile paralysis can be removed finally and completely from the list of great crippling and killing diseases.

BASIL O'CONNOR, *President*

Infantile Paralysis

POLIOMYELITIS, or infantile paralysis, is the most feared of all diseases. While the medical profession has much knowledge of the way in which it is spread, there is still more to be learned. There is no cure in the strict sense of the word but there is much that can be done by proper treatment.

The National Foundation for Infantile Paralysis has prepared this booklet to provide authoritative information. In many hospitals, universities and great laboratories research is being conducted through grants made by the National Foundation. As more information is gained, and as new discoveries are made, they will be placed at the disposal of the entire medical profession for the benefit of mankind.

This booklet is not intended as a guide to treatment of any patient. It seeks to promote a better understanding of poliomyelitis so that the skills and knowledge possessed by doctors, nurses, physical therapists and others can be used to better advantage.

SYMPTOMS

All Degrees of Illness Possible

The symptoms of poliomyelitis vary from the most severe and even fatal to those so mild that a diagnosis is difficult. The severe form of the disease with its typical paralysis is not likely to be overlooked or mistaken for any other illness, although a few other paralyzing diseases may be mistaken for infantile paralysis unless skilled medical and laboratory services are available. In the less severe forms there is more chance for confusion. In the mildest form of the infection a diagnosis can seldom, if ever, be made. Many who have been exposed become "carriers" of the virus without developing any symptoms of illness.

Usually certain indefinite symptoms may precede the paralysis. The onset is sudden. The illness at this first stage is comparatively mild. Sore throat, a head cold,

nausea and sometimes vomiting, are the first symptoms. There may be some slight fever. Since these are the early symptoms of most infectious diseases and minor illnesses they are frequently ignored by the patient and his family. Diarrhea is common but there may occasionally be constipation. Pain or distress in the upper abdominal region may occur and has been confused with acute appendicitis. The appetite is lost. Frequently a striking degree of fatigue and listlessness is noted; yet the patient is apt to be nervous and irritable. Apprehension is out of all proportion to the severity of the other symptoms.

Tremor or trembling of the hands and other parts of the body and pain and stiffness in the neck and back are important and alarming symptoms. Sometimes the patient cannot put his chin on his chest or his head between his knees. Profuse perspiration and flushing of the face may appear on the least exertion, or even without exertion.

Any one or even all of these symptoms may be absent, or they may all be present at one time or another. They do not occur in any regular sequence or with any consistent degree of severity. Occasionally cases have been reported in which paralysis was the first symptom noted — this, however, is most unusual. More commonly there is a period varying from a few hours to several days during which the signs of early illness can be detected. During epidemics or threatened epidemics constant watch should be kept for the occurrence of these minor signs of what may be preparalytic poliomyelitis. A doctor should be called at once.

Keep Close Watch During Epidemics

There is nothing typical or diagnostic of infantile paralysis in these symptoms. Most of them may be found in the early stages of a number of communicable diseases. But when poliomyelitis is known to be present in the community, or when a person is known to have been exposed either to a victim of the disease or someone who has been in contact with him, these signs and symptoms assume greater significance. They call for the immediate attention of the physician.

Pain is almost constant with early paralysis. The muscles of the legs and arms are sore, tender to touch and painful when moved. At this stage of the disease a care-

ful, gentle examination of the muscles, reflexes and spinal fluid may lead to a definite diagnosis by the physician. The disease may not progress beyond this point. Recovery, likewise, may be fairly rapid and complete.

Some patients will go on to develop definite paralysis, particularly those who had much muscle tenderness, pain or disturbance of the reflexes. The ultimate outcome at this point depends greatly on the type of medical care and the skill and persistence with which proper treatment is administered. Muscle involvement should be detected at the earliest stage and the affected part should be treated with the best skill that medical science affords. This requires the attention and services of a physician who can both examine the patient and treat intelligently these early stages of the disease.

Any muscles in the body may be involved, but rarely are they all affected. Seldom are all the muscles of any one leg or arm involved but groups of muscles or even single muscles may be incapacitated. The paralyzing stage of the disease continues to spread for only a short time. Usually 48 to 72 hours after the onset will see the maximum development.

The Spinal Cord is the Seat of Sickness

Infantile paralysis is not primarily a disease of the muscles but rather of the spinal cord and the central nervous system. The spinal cord may be damaged to almost any degree and in almost any part. The effects are seldom uniform or symmetrical. If the nerve cells in the spinal cord are made but slightly ill, or only a few destroyed, then, with proper treatment, there will be only a minor form of temporary muscle weakness; but if many of these nerve cells are killed by the infection, the paralysis may be complete and permanent. New nerve cells cannot grow back to take the place of those that have been destroyed. It is the damage to, or the destruction of nerve cells in the spinal cord that causes the immediate muscle symptoms.

Occasionally the disease will involve the muscles of breathing. In the past the only method of relief has been the use of a respirator or "iron lung". Today, with the patient in the hands of the skilled person applying the Kenny method of relaxation of spasm of muscles, this machine may not be needed.

There are certain forms of paralysis of the muscles of breathing that cannot be relieved either by the respirator or the Kenny method. These forms result from disease of the vital centers of the brain itself. In these cases the respirator may do far more harm than good. This point is mentioned so the parent will realize that at times the physician may rightfully advise the use of the respirator; again he may emphatically advise against its use. His course of action will be guided by the type of disease present and the facilities available with which to care for his patient.

CAUSE OF THE DISEASE

Too Small to Be Seen

The virus which causes infantile paralysis is a form of germ too small to be seen even under the most powerful microscope. It will pass through the finest filters; hence, it has been frequently called an ultra-microscopic or filterable virus. It is not merely size that sets the viruses apart from the more fully understood bacteria. Viruses are complete parasites; that is, they cannot multiply outside the living body cells of their host. They are so small that they lack some of the essential characteristics of living things. They do not have ability to move by themselves. They cannot reproduce by themselves. They must depend for their motion from place to place on the activities of the persons or things infected. They must draw from the healthy living cells of their victims those special substances that are essential for their reproduction and multiplication.

Yet viruses can continue to live for long periods of time outside the body in which they grew and multiplied. Actually, the infantile paralysis virus is most highly resistant to many things that kill bacteria and other more complicated forms of life. It can withstand drying; can be subjected without destruction to many antiseptics and germicides; or it can be kept at temperatures far below freezing and retain its vitality. But it cannot be grown outside living cells as can most bacteria.

Man and Monkeys Susceptible to Polio Virus

The poliomyelitis virus is one of the smallest of the known viruses. Its ability to grow and multiply is not

only limited to living cells, but only to a few cells of but few animals. Man, himself, seems to be the best host for this virus. Then come a few of the monkeys. Other animals have not been found to be routinely susceptible to infection by it. This has limited the laboratory study of the disease. Therefore, not so much is known about this cause of sickness as about the bacteria responsible for diseases such as diphtheria, tuberculosis or whooping cough.

MEANS OF SPREAD FROM PERSON TO PERSON

Poliomyelitis is much more prevalent during the summer and fall months than at other times, but occasionally cases or mild outbreaks do occur during the winter.

Careful Vigilance Necessary to Prevent Spread

Many theories have been advanced as to the manner in which the virus spreads from person to person. There may be several methods of spread. The virus is eliminated from the body of the patient and the carrier with the discharges from the nose and throat but especially from the bowel. Personal contact, droplets thrown into the air by coughing, sneezing or talking; food, milk or other substances soiled with human excretions may spread the virus to a new patient. It is not known how active a rôle insects play in the spread of the disease, but flies trapped in epidemic areas have been shown to carry the virus and mosquitoes have been experimentally infected in the laboratory.

While all the details of the method of spread have not as yet been determined, any method of allowing infected material to be carried from the source of disease (that is, the bodily discharges of a sick patient or a healthy carrier) to the nose or throat or intestinal tract of some other person may apparently cause new cases of infantile paralysis.

INCUBATION PERIOD

Virus Strikes in Four to Ten Days

The time elapsing between entrance of the virus into the body and the development of the first symptoms is the incubation period. In infantile paralysis this seems to be relatively short. In some outbreaks it has been as

short as four or five days; in other cases the incubation period may be as long as ten days or two weeks. Undoubtedly the longer periods occasionally reported have been the result of faulty observation. One or more undiscovered or abortive cases might have occurred between the first paralyzed patient and the next observed case.

IMMUNITY AND RESISTANCE

Not everyone is susceptible to this disease. Many seem to have developed a resistance or an immunity. This immunity is thought to be due largely to a previous mild attack of non-paralyzing, undiagnosed poliomyelitis or repeated exposures to virus doses, too small to produce infection. Most of the reported cases occur in younger children. This age group has not yet lived long enough to come in contact with small or non-infective doses of the virus. The disease as a serious sickness is relatively less common in adults and older age groups. It rarely occurs in small babies less than one year of age.

Paralysis No Respecter of Persons

Little is known about the relationship between nutrition and resistance to the disease. Probably there is little obvious connection. The healthy, the strong and the apparently well-nourished make up their proportion of reported cases. Infantile paralysis is not primarily a disease of the slums, the malnourished or the underprivileged; rather, it often seems to pick out the healthy and the active for its victims.

Serum

Some day, perhaps a serum, a vaccine or a drug will be found that will prevent infantile paralysis, but today there is no such thing. There is nothing the physician can do to immunize the child or to build up his resistance.

PREVENTION

Stand Guard Against Exposure

Since there is no specific means of warding off the disease, such as medical science has provided for diphtheria, typhoid fever, smallpox and many of the other contagious illnesses, prevention, for the present, depends on avoidance of exposure. This is exceedingly difficult, if not even impossible in most cases. During an epidemic

many carriers and persons with the mild undiagnosable forms of poliomyelitis infection unintentionally and unknowingly spread the virus.

There is no practical way to detect these carriers. All that can be done is to prevent unnecessary contact with others. Avoid having children come in contact with new groups of people. Since this disease comes from other infected persons, the less the number of contacts the less the chance of being infected. Even rigid confinement of a child to his home, however, will not always prevent the disease being carried to him.

See that children—and all other members of the household—take nothing into their mouths that could have been soiled by the discharge from the bodies of others.

Screening of the house against flies and mosquitoes may be an important preventive measure as these insects may be capable of carrying the virus from cases or carriers.

Hard and fast rules cannot be formulated relative to attendance at schools. In most communities this and similar problems will be carefully considered by the health officer. In a city the child actually makes fewer new and intimate contacts in school than out of school. In cities children are drawn from a relatively small area. In the country the reverse may at times be true, for here the children may travel long distances, and to them the school may add new hazards and new exposures.

Swimming and Crowds

Swimming may be an important factor. Swimming itself is not thought to be harmful, but if the water is contaminated by sewage or human pollution a definite danger certainly is introduced. Also, if the child meets new people and is exposed to new crowds, then swimming may be a menace even though the water itself is safe.

Little is gained if a community closes the schools and swimming places and allows the children to mingle with crowds of people on the streets, in stores and other common meeting places.

Know Your Health Department

These are problems that must be considered by the health and medical authorities of each community in time of danger. The federal government, each state, every large city and many of the counties maintain de-

partments of health staffed with persons competent to advise in such matters. A conference of the leading health and medical authorities usually leads to the formulation of suggestions designed for a particular community. Parents should study these suggestions with great care and follow them exactly, thereby doing their best to protect themselves and their children and also serving the rest of the community in which they live.

Report Cases

All cases and suspected cases of infantile paralysis should be promptly reported to the local health officer. Quarantine should be willingly followed for the time set by the state. Infantile paralysis epidemics are a matter not for individual action alone, but for concerted action on the part of all people. If carefully observed, authoritative rules and suggestions formulated for the benefit of all give the most effective protection.

TREATMENT

There is no known drug that will "cure" infantile paralysis. The use of serums is not widely accepted as of value. There is no magical or secret method of treatment that has any merit. Every bit of information gained by every reputable physician is immediately made generally available. Such knowledge is published not only in scientific articles but also in newspapers and popular magazines and is broadcast to the people themselves for their use.

Call Your Doctor

In spite of the fact that there is no specific form of treatment, much can be done and should be done by the physician for the patient with infantile paralysis. On the appearance of the very first suspicious symptoms of the disease a physician should be called. His advice should be followed throughout the course of the disease, during both the acute stage and the periods following. The physician can do much to prevent serious complications of poliomyelitis and reduce the crippling that is a common result.

The Kenny Method

The use of splints, frames and plaster casts in the care of the early case of infantile paralysis has been largely replaced by a method of treatment introduced into the United States by Miss Elizabeth Kenny, a nurse from Australia. Miss Kenny has pointed out that the pain and

loss of muscle power in the early stages of the disease are due to spasm or increased irritability of muscles. She has said that there are apt to be stiff joints, twisted backs and deformed legs and arms unless this spasm is treated properly. Without attempting to describe this form of treatment it can be said that it appears to have many advantages over other forms used previously for the care of the infantile paralysis patient.

The Kenny method of treatment, to be of the greatest benefit, should be applied from the very first day of the illness or as soon after as possible. As soon as the diagnosis is made the patient should be treated by hot packs which are an important part of the care. These cannot be administered correctly excepting by those who have had special instruction. While the treatment can be given in the home, hospital care is preferable.

As soon as the muscle soreness and spasm have been relieved the Kenny method calls for re-education of the affected muscles. In the hands of the skilled worker much can be done to return patients to full use of all their muscles so there will be no paralysis or permanent injury. It must be emphasized that not all patients will recover completely. Some will have permanent paralysis, but if proper care has been given the patient from the very first days of illness, the arms, legs and muscles of the body in these more severe cases will be in such shape that an orthopedic surgeon can do much to overcome the effects of the disease. Muscles can be transplanted so that parts of healthy ones will take the place of those which are no longer able to carry on their original work. Joints can be so treated that an otherwise useless leg can be made to bear weight and walking power can be restored.

But surgery may not be enough. Braces may be necessary to help carry the weight of the body and support permanently paralyzed legs and backs. For some patients braces may be a lifelong requirement; for others they may be needed only for a time until weakened muscles have an opportunity to regain their strength, or until healthy muscles can be made to take over the functions of those destroyed by the disease.

Improvement May Go On and On

The whole course of acute infection, rest in bed, physical therapy and surgery may cover many months. Improvement may continue to take place even for years. Experience has taught that maximum improvement occurs when expert care is administered from the very beginning. Not for one moment does the parent or the patient dare relax in this supervision and care.

A Job for the Patient Too

The ultimate success of treatment of paralysis depends not alone on the physician, nurse, physical therapist and hospital staff, but also on the patient and the patient's family. Paralysis in any form and for any period of time is serious. Infantile paralysis, even though it may impair the muscles, does not affect the intelligence.

The patient and his family must realize that certain patients, in spite of all that is done, will remain crippled. Then comes the task of improving the physical state and readjusting the mental state. Weakened muscles in arm or leg need not mean defeat. They need not even offer a serious handicap. Success and a happy and useful life are as possible for the infantile paralysis victim as for anyone else. Improper attitudes on the part of the patient, or the patient's too solicitous family may lead to maladjustments of personality that will be even greater handicaps than the physical crippling. The skilled physician and the wise nurse do much to guide the family in this perplexing problem of mental health.

AVAILABILITY OF CARE

Funds to Secure Proper Treatment

Federal, state and many local governmental agencies have set aside considerable sums of money to furnish care for those who are in need of it. Under the Social Security Act, federal money is made available to states to assist them in providing medical and hospital care for needy crippled children. These funds are administered in the majority of cases either by the state health department or the state welfare department. In some states crippled children services are under special commissions or other agencies. The physician and health officer are thoroughly familiar with the details of the plan. The aim of this wise provision is to see that no crippled child shall go without needed medical care.

The National Foundation for Infantile Paralysis

Each year the National Foundation for Infantile Paralysis conducts its fund-raising campaign. Additional money is thus provided to secure adequate treatment for infantile paralysis patients of all ages. One half of the money that is raised remains in the county; the other half goes to the National Organization to finance its nation-wide program. The local funds of the National Foundation are made available to the community through Chapters, usually established on a county basis. No age limit is placed on those who may receive the services of the Chapters, nor are the benefits confined to the crippled stage of infantile paralysis.

Other agencies, operating on a local or national basis, have been set up to provide assistance in times of danger.

Every physician and every parent should know the facilities, free and otherwise, available in the community. Thus expert care can be provided with a minimum of delay. Here, moreover, is assurance against unnecessary suffering and crippling, and also against the tremendous financial burden involved in caring for needlessly handicapped persons for many years.

Calling All Parents

With parents all over the country rests the responsibility for seeing that everything that can be done *is* done to safeguard the community in which they live from the perils of poliomyelitis. To them the information in these pages is addressed.

Knowledge of the nature of infantile paralysis and of every means which has been discovered to halt its onslaught is the best possible weapon of defense against its devastating effects. It is the duty and function of the National Foundation for Infantile Paralysis, supported by the People, to add to this knowledge so that ultimately poliomyelitis can be brought under complete control.

Don W. Gudakunst, M. D.
Medical Director

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INFANTILE PARALYSIS

(ACUTE ANTERIOR POLIOMYELITIS)

WISCONSIN STATE BOARD OF HEALTH
COOPERATING WITH THE
U. S. PUBLIC HEALTH SERVICE
1946

INFANTILE PARALYSIS

(Acute Anterior Poliomyelitis)

Instances of paralysis occurring in children have been described in the literature of former centuries. Doubtless some of these were cases of what we now call "poliomyelitis". It was, however, not until 1840 that this disease was classed as a separate malady and it was not until 1881 that it was described as occurring in epidemic form. The first known outbreaks were in Sweden and following this it became established the world around largely in the temperate zones of both the northern and southern hemispheres. It was first recognized in Wisconsin in 1908, and has since then been periodically present in local epidemics or waves of general prevalence.

CAUSE

Infantile paralysis is caused by a virus. This organism is too small to be seen under the microscope but laboratory men have found ways of working with it. It can be taken from human beings ill with infantile paralysis and injected into monkeys, which in due time develop the same symptoms as occur in man. In nature man appears to be the only animal affected. The virus is apparently absorbed into the body either from the nasal cavity or from certain parts of the digestive tract and may finally find its way into the spinal cord and damage one or more areas anywhere along it. The paralysis in a muscle is primarily caused by damage to its nerve center in the cord which interferes with proper functioning. Varying degrees of paralysis result from differing degrees of damage in the cord.

SEASON OF PREVALENCE

Infantile paralysis occurs in every month in the year. In Wisconsin two or three cases a month may occur during the winter and spring. The season of increased prevalence begins anywhere from June to August, but is usually in the latter weeks of July. This prevalence continues into September and October and markedly declines in November after a killing frost and cold weather. Where local epidemics are intensive they often seem to abate in two or three months but usually do not entirely disappear until cold weather.

DEMOCRAT PRINTING COMPANY
MADISON, WISCONSIN

EXTENT OF PREVALENCE

The number of persons attacked by paralysis in any one locality is small. Rarely is there more than one paralytic case in a family, although there are instances in which two or more children of the family have been paralyzed. The presence of illness, however, which does not end in paralysis, is frequently observed in other members of the family and it is now known that many of these cases are in reality abortive attacks of infantile paralysis. It is also known that these abortive attacks, which do not go on to paralysis, occur in the general population in regions where infantile paralysis is present, and may so resemble other more common troubles that they escape a correct diagnosis.

Over the last eight years the number of cases and deaths reported in Wisconsin are as follows:

Year	Cases	Deaths	Year	Cases	Deaths
1937	292	41	1941	97	10
1938	38	5	1942	45	9
1939	110	12	1943	206	19
1940	504	46	1944	274	27

AGE AND SEX

The term "infantile paralysis" actually is a misnomer as the disease rarely occurs in infants under one year. It is primarily a disease of early childhood and adolescence. Most victims are under 15 years of age. After that age the percentage declines. During every year of prevalence, however, there are some young adults, and rarely persons in or beyond middle life, who are stricken. Among such cases the death rate is higher than for children. More males are attacked than females but the predominance is not great.

HOW THE DISEASE IS SPREAD

The virus causing the disease has been found in the nose and throat secretions of both abortive and paralytic cases and sometimes in the nose and throat secretions of well persons in the family in contact with a patient. Usually it remains only a short time in these secretions. It is probable that in times of epidemic there are unknown persons in the general population who carry the virus in the nose and throat without having any symptoms. These carriers are likely to be adults as well as children and there is no practical test to identify them. It seems likely, therefore, that much of the disease is transmitted in any manner that the infected nose and throat secretions of

cases, abortive cases and carriers are transmitted. The majority of persons exposed to infantile paralysis will not develop the actual symptoms which indicates that most persons are immune and the immunity is much greater in adults than in children. The virus has also been recovered from the intestinal contents of persons having infantile paralysis and in sewage from epidemic regions. It is probable that substances contaminated with these secretions have an element of danger, such as unwashed foodstuffs consumed raw.

The virus will remain alive in water for many days but does not multiply there. Water, however, is not a common medium of transmission as indicated by the scattered location of cases during epidemics, especially rural cases. Epidemics involve states and counties and are not confined to the limits of any water supply. The fact that the virus lives in water is nevertheless ground for supposition that an occasional case may be contracted through the use of untreated water which has received drainage containing human secretions.

The virus will also live in milk but will not multiply there. Only three or four small outbreaks have ever been reported to have occurred through milk supplies. The wide distance between persons attacked does not incriminate milk as the usual source. Pasteurization will kill the virus.

Because of the season of the year in which infantile paralysis occurs insects have been under suspicion as a causative factor. Experiments with the bites of insects have usually failed to cause the disease to be transferred from man to monkey. The occasional appearance of infantile paralysis in the winter and spring also contradicts this supposition. However, the virus is known to be present in the intestinal discharges of carriers as well as in victims, and has been found in flies, so that effort should be made to prevent food from contamination by flies.

Domestic animals and birds suffer from paralysis but the forms of paralysis from which they suffer have been much investigated and have been found to be caused by other organisms.

It is possible that there are some other factors involving the spread of the virus than have yet been discovered.

SYMPTOMS

In the beginning there is a fever, which may be slight, and some form of gastrointestinal disturbance. The patient may vomit a few times and headache may occur if a child is old enough to complain of it. There may be congestion of the membranes in the back of the throat and a few patients may complain of actual sore throat. Parents

sometimes describe the attack as "flu". These symptoms resemble commoner troubles of childhood and if the malady makes no further progress, it can not be positively diagnosed as infantile paralysis.

As the disease progresses symptoms referable to the nervous system are observed. These are stiff neck, which becomes evident when the neck is bent forward, tenderness along the spine, likely to be demonstrated on bending, and some local tenderness of the muscles. There may be local pain such as in the neck, shoulders, hip or sometimes abdomen. The patient is usually drowsy and at the same time irritable. There is sometimes sweating and pallor about the mouth. One or all of these symptoms may be present. When these symptoms referable to the nervous system occur during times of prevalence of the disease, infantile paralysis may be reasonably suspected. If a spinal tap is made by a physician, the cells in the fluid withdrawn are found to be increased in number. The disease may also end in this stage without going on to paralysis. The symptoms, as above related, are called the preparalytic stage. *It is of the utmost importance that the disease be diagnosed in this stage in order that the patient be isolated from the public and given proper rest.*

The next stage of the disease is paralysis. The virus has here attacked some of the cells in the spinal cord. Any muscle in the body may be involved. It is often an arm or a leg, or rarely, all four limbs. Sometimes the respiratory organs are overtaken and death ensues. There are various grades and combinations to the paralysis ranging from a slightly paralyzed limb to extensive involvements. The paralysis usually appears in one to seven days and even later, but generally from the second to the fourth day after the febrile symptoms have begun. Sometimes the preparalytic symptoms are short or not very pronounced and paralysis is often the first warning of the presence of the disease.

The mortality in various epidemics has been from five per cent to thirty per cent of the known cases. It is usually between eight and twelve per cent of those attacked. Where cases can be traced to other cases, it has been found that the time between exposure and development of symptoms is short and mostly under fourteen days.

TREATMENT

A physician should always be called when there is a suspicion of infantile paralysis. This is important both for the protection of the public and in order that the patient be given proper rest. Rest is required until all tenderness of the body is absent, as movement irritates the inflamed spinal cord and interferes with recovery. This may be three or four weeks or longer. The paralyzed muscles should be

placed or retained in positions which will prevent deformity. The after-treatment of those with paralysis is of the utmost importance.

Proper after-treatment has been markedly successful in restoring limbs to their proper use and correcting deformities. The Crippled Children's Division of the State Department of Public Instruction, Madison, Wisconsin is highly desirous of having correct after-treatment applied to all Wisconsin children. Full information on hospital facilities and upon educational facilities for those afflicted can be obtained by writing to them.

The National Foundation for Infantile Paralysis, Inc., 120 Broadway, New York 5, N. Y. is interested in the various problems connected with the infliction and information and publications may be obtained by writing to them.

PREVENTION

There is as yet no specific means for preventing infantile paralysis The most reliable safeguard is to avoid exposure. The following precautions are deemed advisable when the disease is prevalent:

1. Children with any uncertain illness should be kept at home and in bed until over the trouble. This helps to avoid any strain on the nervous system in case the ailment is infantile paralysis and may help to diminish the severity of it.

2. Keep away from persons sick with any undiagnosed illness.

3. Avoid the use of public drinking cups and towels; wash hands before eating.

4. Children should be cautioned against becoming overtired. It has sometimes happened that children who were exhausted or injured have been overtaken by infantile paralysis.

5. Protect houses from flies by screening; keep flies away from foodstuffs.

6. Avoid drinking unsupervised or impure water. Bathing at public beaches, where the water may be contaminated by sewage and by the mouth secretions of many people, should also be avoided.

7. Avoid tonsil and adenoid operations if possible during epidemics.

8. Because of the suspicion that raw foodstuffs may transmit human secretions through handling during marketing, it is advisable to wash very thoroughly vegetables and fruits which are eaten raw. Washing in a weak salt or chlorine solution is said to destroy the virus. Cooking easily destroys the virus.

9. The opening of schools has not appeared to be followed by an increase in patients, possibly because of the high degree of immunity of most individuals. There may be occasional circumstances where a room has been thoroughly exposed to an ill person, or where there are a number of cases in the school which justify closing. The health officer can be the judge of the circumstances in such cases. If children play with other groups, attend theaters and churches during the closing of school, no benefit is obtained by such closing.

10. It is well to keep children around the home neighborhood and out of crowds notwithstanding that the schools are open. Not only is the interchange of respiratory secretions great in crowds, but people from widely separated areas, some of whom may be carriers from the heavily infected districts, may be present in the congregation.

11. Call a physician at once if the child seems to have any of the symptoms of infantile paralysis. Expert medical treatment given early may prevent many crippling deformities.

RULES AND REGULATIONS

1. **Patient.** The patient shall be isolated and the premises placarded for two weeks from the onset of the symptoms.

2. **Household Contacts.** (a) Children under 18 shall be confined to the premises for the duration of the placarding. If they are removed or the patient is removed, they shall remain on a placarded premises for two weeks from the beginning of onset of the symptoms in the patient. (Note: Should any of the children under placard develop symptoms suggestive of poliomyelitis the placard should be continued for two weeks from date of onset of such symptoms.)

(b) Teachers and others who come in contact with children, and professional food handlers, must cease their occupations and such contact for two weeks from last contact with a case.

3. **Contacts Outside the Home.** Children under 18 who have had intimate contact with a case shall be isolated for two weeks from last contact.

4. **Disinfection.** Concurrent disinfection must be practiced. (Note: Where outside toilets are used by the patients the contents of such toilets shall be kept carefully covered with chloride of lime after each use by the patients for a period of three months after onset of poliomyelitis.)

Note: The physician shall also report infantile paralysis directly to the State Board of Health. See Sec. 143.04—Wisconsin Statutes.

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INFANTILE PARALYSIS
[POLIOMYELITIS]

METROPOLITAN LIFE INSURANCE COMPANY
HOME OFFICE: NEW YORK
Pacific Coast Head Office: San Francisco
Canadian Head Office: Ottawa

WHILE there is much that is still unknown about infantile paralysis, the advice in this pamphlet may help you protect your child from this dreaded disease, and particularly from the deformities which often follow it.

Infantile paralysis is a communicable disease. It occurs most often in the summer months and early fall, commonly among children. In the beginning it resembles many other contagious diseases. A child who has been well becomes restless or drowsy. He is feverish, irritable, and doesn't want to be moved. He is apt to vomit once or twice and may complain of headache or pain in the back or in the back of the neck. He is likely to be constipated but may have diarrhea. More significant are a sore, stiff neck and spine and pains in the back, arms, and legs. Many of these symptoms are not unlike those in the common upsets to which children are subject, but the most serious sign is the stiffness which makes it impossible to bend spine and neck forward.

Sometimes these early symptoms may be very mild, and yet within from 24 to 72 hours the child may be unable to move an arm or a leg. Again he may be unmistakably sick in the first stage of this disease but develop little or no paralysis. Sometimes a child may have so mild a case that the attack is scarcely noticed, and yet he may spread the contagion to other children. Even a doctor who is a specialist in nervous or children's diseases often has to perform a slight operation (lumbar puncture) to be sure of correct diagnosis.

Why It Is Important to Call the Doctor Early

If your child has fever, vomiting, and marked restlessness, put him to bed and promptly call your family doctor. The child may not have infantile paralysis, but, if he has, the doctor may be able to lessen the crippling aftereffects, which are the worst feature of the disease, if he is called in before the arms or legs begin to be paralyzed. Even though your doctor is one of the best, he may wish to have the advice of an orthopedic specialist to supplement his own judgment.

Measures to Prevent Serious Deformity

The degree of deformity which may follow an attack of infantile paralysis often depends on the position in which a muscle becomes paralyzed. A muscle paralyzed on the stretch loses its ability to contract again just as a rubber band which has hardened in a stretched position loses its elasticity. Thus, letting an arm or foot hang over the edge of the bed may lead to serious crippling because the muscles may become paralyzed in this stretched position. A muscle paralyzed while it is contracted also may lead to deformity. Lying with the knees drawn up is one of the positions in which several muscles are contracted. Fortunately, by means of various devices the doctor can do much to control the child's movements so that the muscles are kept in what is called a position of "physiologic rest." Usually this will not interfere with the child's comfort and may save him from becoming a lifelong cripple. The doctor also will tell how to care for and move the patient.

Care of the Paralyzed Child

If your child has had infantile paralysis and is paralyzed, follow your doctor's instructions as to how to strengthen the weakened muscles. This is a very gradual process and requires much patience and perseverance on the child's part, and encouragement from the parents. Proper care and treatment usually bring about improvement during the first year and prevent permanent deformity. This may require prolonged rest in bed and possibly irksome treatment. But do not get discouraged. Improvement has been known to continue for several years. While guaranteed or advertised "cures" are usually unreliable, yet often much can be done under the advice of an experienced physician to restore the muscle balance, and make normal activity possible.

Preventing the Spread of Infantile Paralysis

There is much about infantile paralysis that is not yet understood, but it is believed that the virus causing the disease is spread directly and indirectly from one person to another, much as other

contagious diseases of childhood are spread. One may even carry the infection without showing symptoms of the disease; in fact, "healthy" carriers may be more numerous and active in spreading it than active cases.

When a child has infantile paralysis he should be put to bed, away from other members of the family, the doctor called, the case reported to the Department of Health, and measures taken to protect others, as directed by the doctor or the Health Officer.

If Infantile Paralysis Is Near

If there is an epidemic of infantile paralysis or of other contagious diseases in your community, it is a good rule to keep your child out of crowds. Avoid the movies, theaters, parties, dances, picnics, and crowded boats and trains until the epidemic is over. Health authorities differ as to whether children should be kept in school; sometimes schools are closed for short periods to try to stop the disease from spreading. Keep your child away from homes where there is sickness. If you have a yard, let your child play in it. The roofs of apartment houses, when properly protected against accidents, often are fine playgrounds.

The general rules of health are always important. Parents should see to it that children wash their hands before eating, that they do not use public towels or common drinking cups, that they cover nose and mouth when sneezing or coughing, and that they keep fingers out of nose and mouth and put nothing in the mouth which has been soiled in the slightest degree by others. A child should never be kissed on the mouth. He should have good, simple food, including pasteurized milk, at home and for his school lunches, and plenty of water to drink. He should go to bed early and have regular bowel movements.

It is desirable to keep the house as clean as possible. Use plenty of soap and water; fight flies, mice, rats, and other vermin; and remember that fresh air and sunlight are destroyers of germs.

This leaflet was prepared with the cooperation and advice of the former Milbank Infantile Paralysis Commission.

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(i) 353 L.W.

The Essentials of Chapter Service in an Infantile Paralysis Epidemic

THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS
FRANKLIN D. ROOSEVELT, Founder
120 Broadway, New York 5, N. Y.

Unified Action

The Chapter of The National Foundation for Infantile Paralysis should arrange to be kept informed by the Health Department of any increase in infantile paralysis in its county or nearby areas. Epidemics of infantile paralysis are not explosive by nature, but they grow and develop rapidly. They cannot be accurately predicted, but they can be anticipated. A community that is prepared to meet such an emergency has done all that today is possible, for the disease cannot be prevented or its spread even checked.

When an outbreak occurs the Health Department is the agency primarily responsible for all control measures. Treatment and medical care are the responsibility of many official and voluntary agencies. The Chapter of the National Foundation has the opportunity to assist in coordinating the services of these various groups; to analyze their strengths and weaknesses; and to supply whatever may be needed to assure good medical care for all infantile paralysis patients.

Careful planning by the Chapter in collaboration with state, county, city, and local health, medical, and social agencies is recommended. The Chapter should suggest to the local health officer that a meeting be called for the purpose of establishing a unified program. Officers of the Chapter, chairmen of the Chapter's special committees, local health officers, the State Representative of the National Foundation, representatives from the county medical society, the chiefs of staff and superintendents of hospitals, the superintendent of schools, editors of newspapers, directors of The Crippled Children's Service, Public Health Nursing supervisors and representatives of the Visiting Nurse and District Nurse associations should be invited to attend such a meeting.

The questions to be discussed and answered at the meeting are: "What does the community have, and what does it need to meet an epidemic?"

The National Foundation and its Chapters constitute one organization. An outbreak calls for the mobilization of all its forces and resources on both local and national levels so that no person with poliomyelitis need go without the best available medical care for lack of funds — regardless of his age, race, creed or color.

Essentials of Chapter Service

1. The Chapter should be thoroughly familiar with hospital facilities in its area.

   Check these essentials: —

   How many hospitals are there?

   How many admit acute or early infantile paralysis cases?

   How many beds do they have?

   What is the *maximum* number of cases that can be admitted during the summer and early fall?

   Are beds available for convalescent and orthopedic cases in later stages of the disease?

   Would it be necessary to revise existing public health laws and regulations in order to provide sufficient beds to handle an outbreak affecting 20, 50 or 100 patients for each 100,000 unit of population?

   What can be done to make more beds available?

   Do your hospitals admit cases regardless of age, race, creed or color?

2. The Chapter should be familiar with medical facilities in its area.

   Check these essentials: —

   Are adequate diagnostic services available for all patients, including laboratory facilities for spinal-fluid and other examinations?

   How many pediatricians, orthopedic surgeons and doctors of physical medicine practice in your area? Are they ex-

perienced in modern treatment methods for infantile paralysis?

If there are no physicians with special interest and training in poliomyelitis in your area, where are the nearest ones located, and can their services be obtained if an epidemic develops?

How many registered nurses are there? How many of them have had special training in infantile paralysis care?

How many registered physical therapists are there? Have they been trained in the treatment of infantile paralysis?

How many volunteers have been trained through the Chapter's PEV program to assist physicians, nurses and physical therapists in the care of infantile paralysis patients?

Are hot pack machines available? Do you know where to get additional ones if necessary? For emergency use, are washing machines and wringers available as substitutes for hot pack machines?

How many respirators are on hand in hospitals that admit acute cases of infantile paralysis? Have they been recently inspected and serviced to insure good working order? Are doctors, nurses and hospital staffs familiar with their operation? Do you know where and how to obtain additional respirators, quickly, if they are needed?

Are ambulances available to transport patients to the hospitals? Do the drivers know how to handle infantile paralysis patients?

(Information about the transportation of infantile paralysis patients is available upon request to National headquarters.)

What the Chapter Can Do in an Epidemic

1. Pay all or any part of hospitalization costs as needed.
2. Provide funds to hospitals and other agencies to pay salaries of special and general duty nurses, physical therapists and other professional workers employed for the care of infantile paralysis patients.

3. Provide transportation and maintenance and secure living accommodations for these professional persons, if secured from other communities.
4. Make funds available to hospitals, clinics and Health Departments for the employment of extra non-professional help as necessitated by the epidemic. This would include clerks, receptionists, aides, orderlies, kitchen and floor helpers, telephone operators, etc.
5. Make funds available for renting and equipping of an emergency center to be operated in conjunction with already existing facilities.
6. Pay for medical care, including diagnostic and consultation services, and medical and surgical treatment.
7. Pay for laboratory services.
8. Furnish educational and information services to those patients not requiring financial assistance.
9. Recruit volunteers to assist physicians, nurses and physical therapists in treatment.
10. Serve as a clearing house for volunteer personnel.
11. Rent or secure a central office to facilitate and centralize service.
12. Employ clerical and accounting assistance for the keeping of records.
13. Establish a telephone registry where hospital reports may be received at regular intervals and conveyed to the families of patients, thereby relieving the serious strain on hospital staffs.
14. Purchase additional hospital and clinic equipment needed in the treatment of infantile paralysis. Select only that equipment for direct treatment of patients which has been approved by the Council on Physical Medicine of the American Medical Association.
15. Telephone or telegraph the National Headquarters for the loan of a respirator – indicating type of current available.

Buy a respirator only if it is really needed. The decision

to purchase one should be made by the Medical Advisory Committee in consultation with health and hospital officials. Be sure that the machine is approved by the Council on Physical Medicine of the American Medical Association.

16. Arrange and pay for transportation such as ambulance service to hospitals and clinics, and taxi or private car service for medical checkup in the post-isolation period.
17. Supply literature approved by National Headquarters to physicians, nurses and the general public.
18. Secure the cooperation of the local press and radio stations in appealing for blankets, waterproof materials, wringers, washing machines, tubs, electric fans, footboards, etc., if they are needed.
19. Arrange meetings and conferences in cooperation with the Health Department and the Medical Society.
20. Publicize in cooperation with health authorities all efforts being made to meet the situation, thus helping to allay fear and panic.

What the Chapter Can Do at All Times

1. Pay all or part of patient hospitalization costs, medical and surgical fees, when necessary, for all infantile paralysis patients regardless of the date of onset of the disease.
2. Provide funds for post-graduate study by doctors, nurses and physical therapists so that they may learn all there is to know about the diagnosis and treatment of infantile paralysis.
3. Provide scholarships for training in physical therapy. Encourage young men and women to enter this field and do all in its power to assure employment for them by some hospital or agency in the county.
4. Provide funds to hospitals and other agencies to pay all or part of salaries of nurses and physical therapists employed to care for infantile paralysis patients.
5. Develop an educational program so that the general public may be informed about infantile paralysis through use

of publications, exhibits and posters available from the National Foundation.

What the Chapter Cannot Do

1. Pay for the treatment or care of any disease or crippling condition other than infantile paralysis.
2. Finance research.
3. Spend funds for the erection of buildings.
4. Operate its own clinic or hospital or in any manner engage in the practice of medicine.
5. Spend a sum in excess of $2,000 for any one project without first obtaining the permission of the National Foundation.
6. Print literature without the approval of the National Foundation.
7. Put nurses, physical therapists or other professional personnel on the Chapter payroll.

What the Headquarters of the National Foundation Does

1. Whenever the financial resources of a Chapter have been exhausted because of the demands of an epidemic, National Headquarters will advance sufficient funds to enable the Chapter to fulfill its obligations to the people of the area it serves.
2. Secures services of additional professional personnel as requested by local health and medical authorities. Such personnel includes physicians, nurses, physical therapists and epidemiologists.
3. Arranges for the loan of respirators for emergency use.
4. Provides general advisory services for professional and community groups.
5. Supplies informative literature to the general public, educators, professional, medical and health personnel.

6. Participates in preparedness programs attended by public health officials, hospital administrators, medical and professional groups, and Chapter personnel.

   Initiates and develops plans for the improvement of medical care for infantile paralysis patients throughout the United States.

7. Upon emergency need, obtains and sends equipment and materials for epidemic use, such as wool for hot packs, hospital supplies and respirators.

8. Arranges, on request of health and medical authorities, for Epidemic Aid Units consisting of infantile paralysis experts to give temporary assistance in organizing the hospital and training local and recruited personnel.

9. Sends a public relations representative, upon the request of a Chapter and the State Representative, to assist in the dissemination of information to help prevent panic and assist in the coordination of community activities.

Be Prepared to Meet Any Emergencies!

FIGHT
INFANTILE
PARALYSIS

This publication made possible through
THE MARCH OF DIMES

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	LEFT									RIGHT
					Examiner's Initials					
					Date					
SCAPULA					Abductor — Serratus anterior					SCAPULA
					Adductor — middle trapezius					
					Adductors — Rhomboids					
					Elevators					
					Depressor					
SHOULDER					Flexors					SHOULDER
					Extensors					
					Abductors					
					Horizontal Abductor					
					Horizontal Adductor					
					External rotators					
					Internal rotators					
ELBOW					Flexors					ELBOW
					Extensors					
FOREARM					Supinators					FOREARM
					Pronators					
WRIST					Flexor — radial deviation					WRIST
					Flexor — ulnar deviation					
					Extensors — radial deviation					
					Extensor — ulnar deviation					
FINGERS					Flexors — metacarpophalangeal					FINGERS
					Extensors — metacarpophalangeal.					
					Flexor — proximal interphalangeal					
					Flexor — distal interphalangeal					
					Abductors					
					Adductors					
					Opponens — 5th finger					
THUMB					Opponens					THUMB
					Flexor — metacarpophalangeal					
					Extensor — metacarpophalangeal					
					Flexor — interphalangeal					
					Extensor — interphalangeal					
					Abductors					
					Adductor					
					MEASUREMENTS					
CHEST					Inspiration					CHEST
					Expiration					
ABDOMEN					Umbilicus to Ant. Sup. Spine					ABDOMEN
LOWER EXTREMITY					Circumference — mid calf					LOWER EXTREMITY
					Circumference — mid thigh					
					Ant. Sup. spine to int. malleolus					
					Umbilicus to internal malleolus					

Cannot walk Date_____ Walks with crutches Date_____

Stands Date_____ Walks with canes Date_____

Walks with braces Date_____ Walks unaided Date_____

Walks with corset Date_____ Climbs stairs Date_____

Other Apparatus_____

Scoliosis and other deformities_____

Supplied by The National Foundation for Infantile Paralysis, Inc., 120 Broadway, N. Y. 5, N. Y., Publication No. 60.

Revised March 1946

Muscle Examination

Patient's Name _____ Chart No. _____

Date of Birth _____ Name of Institution _____

Date of Onset _____ Attending Physician _____ M. D.

Diagnosis:

	LEFT					RIGHT				
					Examiner's Initials					
					Date					
NECK					Flexors					NECK
					Extensors					
TRUNK					Flexor					TRUNK
					Extensors — thoracic					
					Extensors — lumbar					
					R. ext. obl. / L. int. obl. } Rotators { L. ext. obl. / R. int. obl.					
					Elevation of pelvis					
HIP					Flexors					HIP
					Extensors					
					Abductor					
					Adductors					
					External Rotators					
					Internal Rotators					
					Sartorius					
					Tensor fasciae latae					
KNEE					Flexor — outer hamstring					KNEE
					Flexors — inner hamstrings					
					Extensors					
ANKLE					Plantar-flexors — Gastroc. & Soleus					ANKLE
					Plantar-flexor — Soleus					
FOOT					Invertor — Anterior tibial					FOOT
					Invertor — Posterior tibial					
					Evertor — Peroneus brevis					
					Evertor — Peroneus longus					
TOES (4 lateral)					Flexors — metatarsophalangeal					TOES (4 lateral)
					Extensors — metatarsophalangeal					
					Flexor — proximal interphalangeal					
					Flexor — distal interphalangeal					
					Abductors					
					Adductors					
HALLUX					Flexor — metatarsophalangeal					HALLUX
					Flexor — interphalangeal					
					Extensor — interphalangeal					

Additional Data:

Face _____

Speech _____

Swallowing _____

Diaphragm _____

Intercostals _____

KEY

100%	5 N	Normal	Complete range of motion against gravity with full resistance.
75%	4 G	Good*	Complete range of motion against gravity with some resistance.
50%	3 F	Fair*	Complete range of motion against gravity.
25%	2 P	Poor*	Complete range of motion with gravity eliminated.
10%	1 T	Trace	Evidence of slight contractility. No joint motion.
0	0 0	Zero	No evidence of contractility.
	S or SS	Spasm	Spasm or severe spasm.
	C or CC	Contracture	Contracture or severe contracture.

*Muscle Spasm or contracture may limit range of motion. A question mark should be placed after the grading of a movement that is incomplete from this cause.

	LEFT					RIGHT				
					Examiner's Initials					
					Date					
SCAPULA					Abductor — Serratus anterior					SCAPULA
					Adductor — middle trapezius					
					Adductors — Rhomboids					
					Elevators					
					Depressor					
SHOULDER					Flexors					SHOULDER
					Extensors					
					Abductors					
					Horizontal Abductor					
					Horizontal Adductor					
					External rotators					
					Internal rotators					
ELBOW					Flexors					ELBOW
					Extensors					
FOREARM					Supinators					FOREARM
					Pronators					
WRIST					Flexor — radial deviation					WRIST
					Flexor — ulnar deviation					
					Extensors — radial deviation					
					Extensor — ulnar deviation					
FINGERS					Flexors — metacarpophalangeal					FINGERS
					Extensors — metacarpophalangeal.					
					Flexor — proximal interphalangeal					
					Flexor — distal interphalangeal					
					Abductors					
					Adductors					
					Opponens — 5th finger					
THUMB					Opponens					THUMB
					Flexor — metacarpophalangeal					
					Extensor — metacarpophalangeal					
					Flexor — interphalangeal					
					Extensor — interphalangeal					
					Abductors					
					Adductor					
					MEASUREMENTS					
CHEST					Inspiration					CHEST
					Expiration					
ABDOMEN					Umbilicus to Ant. Sup. Spine					ABDOMEN
LOWER EXTREMITY					Circumference — mid calf					LOWER EXTREMITY
					Circumference — mid thigh					
					Ant. Sup. spine to int. malleolus					
					Umbilicus to internal malleolus					

Cannot walk Date_____ Walks with crutches Date_____

Stands Date_____ Walks with canes Date_____

Walks with braces Date_____ Walks unaided Date_____

Walks with corset Date_____ Climbs stairs Date_____

Other Apparatus_____

Scoliosis and other deformities_____

Supplied by The National Foundation for Infantile Paralysis, Inc., 120 Broadway, N. Y. 5, N. Y., Publication No. 60.

Revised March 1946

Reprinted from the American Journal of Nursing, Vol. 47, June 1947

Psychological Considerations in Poliomyelitis Care

by Morton A. Seidenfeld, PH.D.

TWENTY-THREE CENTURIES ago Hippocrates pointed out that the art of medicine consists of three things: the disease, the patient, and the physician. The patient, together with the physician, must combat the disease. Today those who are engaged in the task of caring for the sick can be supplied with no better guide to their rôle than the above aphorism. Particular emphasis may be placed upon this concept in our consideration of all the elements in the medical care of the patient with poliomyelitis. This patient is generally a child or an adolescent to whom life has just begun to reveal its meaning to a degree sufficient to make him eager to participate fully and completely. Abruptly, and with blind ruthlessness, the crippling virus of poliomyelitis descends and terminates temporarily, and sometimes permanently, such aspirations.

You, the nurse, will frequently find yourself one of the first professionally trained individuals in direct contact with the patient. You are, therefore, in the strategic position of offering prompt care not only to the physical ills which are in evidence but to the mental disturbances which tend to follow on the heels of the uncertainty experienced by the sufferer. Philosophically your desire is to render this patient every consideration possible. Practically you may well ask "What can I do to help this patient over his psychological hurdles?"

There are many things that you can do to ease psychological discomfort. Some of the most important steps you may take in this direction are discussed below. They are by no means all the things you can and will do along these lines but they are definitely the procedures that should be introduced as early in the patient's program as is possible.

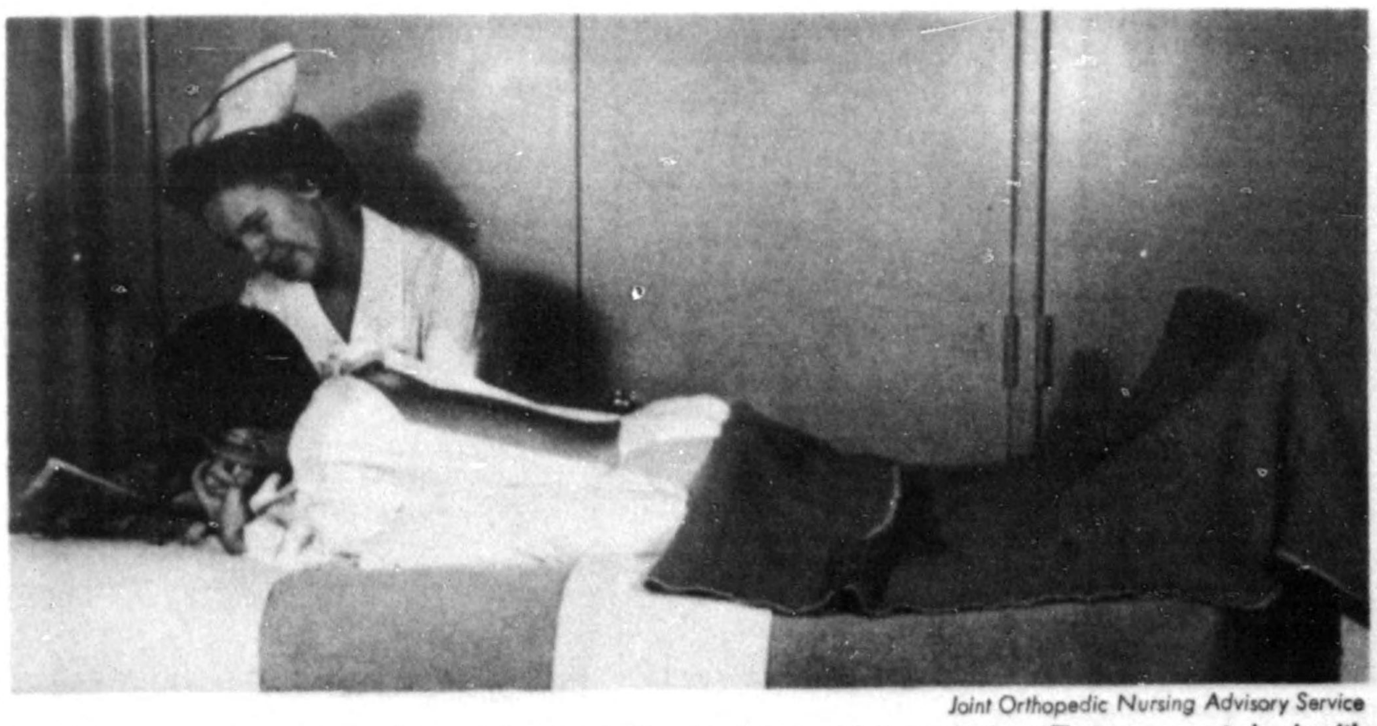
First you must keep in mind that when this patient comes to the hospital, he enters as "Poliomyelitis, acute." But that isn't his name at all. He is Johnny Jones, called "Red" by his buddies, he's eleven, and only a few hours ago he was captain of his sand-lot baseball team and pleased as Punch because his coach, Bill Smith, said he was a "natural" for the big leagues. Now he's lonely, afraid, and sure that he'll never know the feel of a bat or a catcher's mitt again. This is the time "when a feller needs a friend" for certain.

Here is your first job as a psychologically-minded nurse. You are with Johnny a good bit during those early days of his acute illness. He needs the lift that you can give him by letting him tell you about those memories of the ball field, and about his mom and dad. Give him the chance to "get it off his chest." Sure, it will take time. Sure, you are busy with a dozen other youngsters on the ward. But don't forget that this *is* nursing care and to Johnny it may be as calming in its effects as phenobarbital and more lasting in its values.

Through this procedure you may often detect more serious mental disturbances which need to be brought to the attention of the physician. Fundamentally this whole process of listening to your patient when he needs to "let his hair down" is part of a preventive mental hygiene plan for the patient that will tend to avert severe tensions simply by relieving them before they become so powerful that the patient cannot cope with them himself.

As you become more and more familiar with the individual patient, with the medical and surgical plan, the physical therapy and occupational therapy program, and the social work which is being done, you will be able to strengthen these programs as well as your own nursing care plan for the patient by pointing out to him how carefully his return to health and a life filled with satisfactions is being planned for him.

Don't worry too much about the time this is going to take. During the first few days perhaps it will tax you a bit but after the patient has gotten over his initial fears and has been enlightened about his treatment plan he will not have as many problems. Soon you will know the patient and know when he is just "chatting" and when he is "letting off steam." There is a considerable difference in the emotional tone that you will recognize. Cut the "chats" short if you are pressed for time but "letting off steam" should go on at least long enough for you to get at the nature of the problem. Thus you will be able to pass it on to an appropriate member of the medical team (the doctor and the entire medical auxiliary staff who care for the patient) for their attention.



Joint Orthopedic Nursing Advisory Service

Reading and coloring are good recreational activities for the convalescent patient. The nurse must check with the doctor or the physical therapist to be certain that this position is permissible. In spinal, shoulder, or abdominal muscle involvement this position might be contraindicated.

DR. SEIDENFELD is Director of Psychological Services, National Foundation for Infantile Paralysis, New York City.

The second important psychological task which is intimately related to the nursing care of the patient is in preventing, in so far as possible, the development of a "vegetating" attitude in the patient. The "vegetating" attitude is that indolent, indifferent, "waiting for something to happen but really don't care if it does" viewpoint which unfortunately is all too often seen in patients with all sorts of chronic diseases including those with orthopedic involvements. The cause of this frame of mind so far as one can place it, seems to be centered in the failure of hospital personnel to schedule patients in a manner that considers the patient's feelings as well as those of the professional personnel.

Take for example little Mary Query. She's that sweet little girl of fourteen who was abruptly and unceremoniously separated from home and school seven months ago. Mary is a bright girl, she has a good bit of lower limb involvement but her upper extremities are fine. Mary could get schooling. She started training for commercial art for which she seems to have a lot of talent. But is Mary doing anything? No, indeed! At first she was interested but nearly every time she got started with her work Mary was re-scheduled for physical therapy and oftentimes waited in a hallway for thirty minutes or an hour until her turn for the "physio" actually arrived. Other times Mary would just about get started when her tray arrived, or her teacher changed her schedule and couldn't give Mary her instruction. After a few weeks of such experiences is it any wonder that Mary "just doesn't care"?

Now don't misunderstand what has been said. Many, perhaps all, of these things have to be done for Mary, or Joe, or Tommy or Alice. But must they always be done without a plan? Certainly not, because we do have hospitals that are fairly free of such deficiencies and where the patient is maintained on a more or less regular schedule which includes ample time for educational and avocational activities that are designed to keep alive their perspective for fitting into normal living after hospitalization and convalescence are over. You, as a nurse, interested in your patient's total recovery, and as a member of the medical team, must fight for the establishment of an organized schedule of activities as against a helter-skelter program which always leaves the patient so uncertain as to what is coming next that he feels no inclination to participate in anything but prefers to "wait for things to happen."

The third and last item which needs to be stressed in the present discussion is your responsibility not only in carrying out prescribed nursing procedures but, in addition, supplying to the patient an understanding of what is being done and what it is going to do for him. Too often all of us who work in hospitals and institutions take for granted that the mere fact that we are invested with a title which authorizes us to carry on our work is sufficient to make the patient feel quite confident that we are doing the right thing. Unfortunately for us, that isn't true. Patients are curious, worrisome, and frightened by actions which they do not understand. We must seek, whenever possible, to anticipate the patient's apprehensions by telling him what we are doing, what we hope to achieve and how he can participate and help us to help him.

Obviously such explanations should be simple and free of scientific obscurities. Be specific, open and above board, and even a child of two or three will be more co-operative, more secure, and far less emotionally disturbed by your actions.

From time to time you may find it necessary to give similar explanations to parents. They need your help, oftentimes almost as much as the patient. When in a few words you can clarify some of their misgivings about a nursing procedure you owe it to them, to the patient, and to yourself to do so.

This is not to be considered as an epitome of the psychological aspects of nursing care for polio or for any other type of patient. It is merely a brief presentation of three psychological practices which you can adapt and mold to fit your own practical nursing situation. Many of you are doing these things, and more, right now. To those who aren't, it is suggested that you at least give them a trial and see if they won't help you to render increased care to your patients.

Copies of this reprint are available upon request to the National Foundation for Infantile Paralysis, 120 Broadway, New York 5, N. Y.

Problems of Poliomyelitis

By HART E. VAN RIPER, M.D., Medical Director, The National Foundation for Infantile Paralysis, New York, N. Y.

Reprinted from THE MERCK REPORT, *January 1947*

Problems of Poliomyelitis

By HART E. VAN RIPER, M.D., Medical Director, The National Foundation for Infantile Paralysis, New York, N. Y.

"RESEARCH begets more research" aptly describes the history of scientific investigations in the medical enigma, poliomyelitis. Stemming from Jakob Heine's keen observations in 1840, which strangely enough remain essentially true today, research in the disease has multiplied tremendously. It may well be said that the intensive phase of such studies had its impetus in 1938 with the formation of The National Foundation for Infantile Paralysis.

Heine's studies were of sporadic cases, for prior tc 1880 there were no characteristically epidemic outbreaks as we experience them today. The reason for this change from an endemic to epidemic character still remains a fundamental riddle. Oskar Medin made his contribution to the science of poliomyelitis by recording his observations in 1890 of one of the first epidemics to occur in Sweden. It was the deductions of these two men—Heine and Medin—which laid the cornerstone for modern research.

However, experimental studies of the disease were stymied because scientists were unable to find a suitable laboratory animal which would accept infection. Then, in 1908, Dr. Karl Landsteiner made the first successful transmission of poliomyelitis to an animal—the monkey. His work was followed a short time later by the contribution of Dr. Simon Flexner, who demonstrated that it was possible to pass the experimental infection from one monkey to another in series. Flexner's contribution went beyond this when he shortly proved that the infectious agent could pass through the finest earthen filters. And thus he demonstrated that the causative organism of poliomyelitis was a filtrable virus.

The stage now was set for a comprehensive scientific assault on the disease, but there were other difficulties. Monkeys were expensive and difficult to obtain. Research in poliomyelitis was costly, and there were few investigators with sufficient resources to enable them to conduct the protracted studies necessary. As a result, investigations were sporadic and could not be planned and carried out for long-term periods. With the formation of The National Foundation for Infantile Paralysis in 1938, intensive scientific research in the disease became a possibility. The generous support of the American people to the March of Dimes gave scientists the opportunity of making a broad, intensive attack on the disease.

Today, after nine years of such support, our fund of knowledge has increased materially. Poliomyelitis is emerging from the cloud of obscurity surrounding it. The edges of the picture are more sharply limned. With the discarding of many previously held false theories there gradually is emerging what scientists hope will soon be a sharply etched picture of the true nature of poliomyelitis.

It is known that the virus causing poliomyelitis is one of the smallest of disease-producing agents. Nucleoprotein in nature, its size is estimated from 10 to 25 millimicrons. As so often is true of other disease-producing organisms, there is not merely a single virus capable of causing poliomyelitis, but many strains, approximately 20 in number, each with markedly different characteristics in immunology, pathogenicity, and infectivity. With the advent of the electron microscope it was hoped that visualization of the virus would be a quick possibility. But so far scientists still are uncertain, in viewing virus-laden material through the electron microscope, whether they are seeing the actual agent of the disease or merely some of the contaminating protein material with which it still is associated. The virus has not yet been isolated in its absolutely pure state, although scientists recently have made signal advances in the physical and chemical methods for its purification.

The epidemiology of poliomyelitis has presented one of the most obstinate problems in research. One of the basic drawbacks has been the lack of a rapid, accurate laboratory test for determining the presence of the virus. The method at hand for the identification of the virus is by animal inoculation, which, no matter how well-done, is uncertain if the test is negative. Only monkeys serve as suitable animals for this test, and each examination means the sacrifice of five or ten such animals. These tests require weeks or even months for determination, and are prohibitively expensive as a routine procedure.

A careful search for the presence of the virus in nature has been entirely negative. Man himself is the only reservoir of the disease organism. On occasions, flies have been found to contain the virus. But no human cases have been traced to this agent. The significance of flies in the transmission of the disease still is uncertain. Similarly, the occasional presence of virus in sewage has not been proved a link in the transmission of human cases. The scientific thinking today is that the transmission of poliomyelitis depends on an intimate person-to-person contact.

With the evidence that the virus is found in the secre-

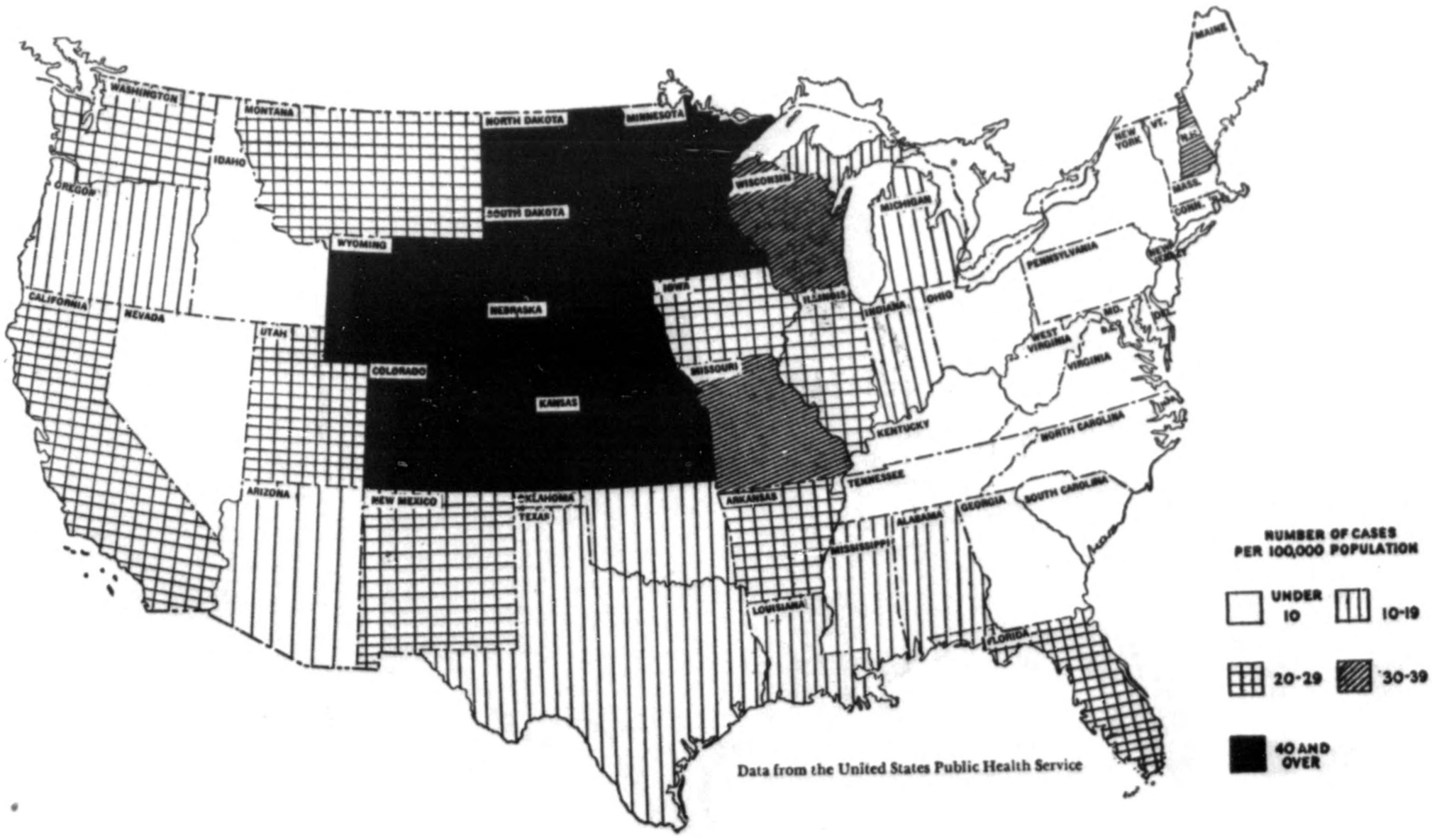
tions of the oropharynx, and in the stools of the acute patients, abortive cases, and healthy carriers as well, it is realized that poliomyelitis during and in epidemic areas is a more widespread disease than commonly believed. Relatively few of the infected persons, however, develop recognizable symptoms. Recent studies indicate that for every patient with symptoms of the acute disease there may be 100 individuals without significant clinical signs. In the light of such findings, paralysis may be regarded as a rare sequela of a widespread, ordinarily innocuous infection. Some investigations have disclosed that approximately three-quarters of the members of the families of acutely ill patients were healthy carriers of the virus. A lower percentage of less intimates of the acute patients was found to be harboring the infecting organism. And the number of positive virus findings rapidly decreased as the radius from the acute patients increased.

Treatment today can neither prevent paralysis nor cure patients, but it can prevent deformities and minimize the crippling after effects of the disease. Physical therapy, used early and continuously and based on the individual patient's needs, lessens the stiffness of joints, the shortening of muscles, and the deforming contractures. What may be even more important is that physical therapy as applied today makes the most of the residual strength of muscles. Under the careful, skilled hands of nurses and technicians, patients can be taught the effective use of legs, arms, and backs, that once might have been considered hopelessly paralyzed. In hundreds of general hospitals having the necessary departments of physical medicine, many thousands of poliomyelitis patients have received modern treatment. From many of these centers, reports indicate about 75 out of every 100 patients recover without any handicaps. Approximately 20 of the 100 suffer permanent crippling, and five out of the 100 die.

Advances in corrective surgery continue to offer additional hope for those who do suffer permanent handicaps. Muscle and tendon transplants, fusion operations, and neurotripsy, when indicated, can provide additional function to a paralyzed limb or back. The results of treatment continue to improve, especially if physicians remain alert in diagnosing poliomyelitis and instituting proper treatment in the early stages of the infection. With an increasing awareness by physicians to the problems of poliomyelitis, the number of cases now left with permanent handicaps can be further reduced.

There is much difficulty in predicting what areas of the country will be menaced by epidemics of poliomyelitis in a coming year. But geographic studies of previous years have indicated a cyclic appearance of the disease occurring in four-to-six-year intervals. While this method is not scientifically accurate, it is of value in anticipating outbreaks and preparing an area for the rigors of an epidemic. If a community has been free of the disease for four or more years, it is extremely important to take stock of treatment facilities. Much

Distribution of Infantile Paralysis in the United States—1946



Data from the United States Public Health Service

can be done beforehand in providing the essential facilities for adequate care of patients. In co-operation with the official health agencies of the city, state, and county, The National Foundation has made it a part of its program to help communities prepare before epidemics strike. The resources of The National Foundation and its 2,712 chapters can be used to provide a community with the wherewithal—hospital beds, hot-pack machines, hydrotherapy tanks, and respirators, as well as trained nurses, doctors, and physical therapists.

The value of this preparedness was evident in the 1946 outbreaks of the disease which, up to the present time, have already reached 24,000 cases, the second largest epidemic in the recorded history of the disease in the United States. The outbreaks were most severe west of the Mississippi River, concentrating in Minnesota, Kansas, Illinois, Missouri, Colorado, Texas, Florida, and California.

In many of the epidemic areas, establishment of treatment facilities was hastened by the dispatching of epidemic-aid units organized by The National Foundation for Infantile Paralysis at Harvard, Northwestern, and Stanford Universities, and the D. T. Watson School of Physical Therapy. Several of these units, usually consisting of orthopedists, pediatricians, nurses, and physical therapists, were sped to stricken areas early in the epidemic. These teams of experts aided local authorities in setting up standards of care for patients and trained other personnel to carry on continuous-treatment programs. Hot-pack machines and respirators were gathered from all parts of the country and sent to communities which needed them. More than 200 physical therapists were recruited by The National Foundation to facilitate treatment of victims in various states. Some 1,500 nurses were mobilized by the American Red Cross, with The National Foundation paying transportation, maintenance, and salaries. To help meet the costs of adequate treatment, The National Foundation sent its chapters $3,500,000 when their individual funds were exhausted.

The severity of the epidemic stressed the need for skilled personnel of all kinds to ensure maintenance of standards of care and to conduct research. Fortunately, the educational programs of The National Foundation had already increased the numbers of trained workers. But the cry is for even more doctors, nurses, and physical therapists skilled in poliomyelitis research and treatment. To meet that need The National Foundation is continuing to offer scholarships and fellowships in virology, pediatrics, orthopedic surgery, public health, clinical neurology, sanitary engineering, and physical therapy. In addition, the chapters of The National Foundation are eager to provide doctors, nurses, and physical therapists in their communities, with training at recognized institutions in the modern treatment of infantile paralysis.

Although the problems of poliomyelitis have not yet been solved, they are being met in dozens of research laboratories throughout the nation, and in the hundreds of hospitals where excellent care is assured all poliomyelitis patients, regardless of race, creed, color, or ability to pay.

Muscle Examination

Patient's Name _____ Chart No. _____

Date of Birth _____ Name of Institution _____

Date of Onset _____ Attending Physician _____ M. D.

Diagnosis:

	LEFT					RIGHT				
					Examiner's Initials					
					Date					
NECK					Flexors					NECK
					Extensors					
TRUNK					Flexor					TRUNK
					Extensors — thoracic					
					Extensors — lumbar					
					R. ext. obl. / L. int. obl. } Rotators { L. ext. obl. / R. int. obl.					
					Elevation of pelvis					
HIP					Flexors					HIP
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					External Rotators					
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					Plantar-flexor — Soleus					
FOOT					Invertor — Anterior tibial					FOOT
					Invertor — Posterior tibial					
					Evertor — Peroneus brevis					
					Evertor — Peroneus longus					
TOES (4 lateral)					Flexors — metatarsophalangeal					TOES (4 lateral)
					Extensors — metatarsophalangeal					
					Flexor — próximal interphalangeal					
					Flexor — distal interphalangeal					
					Abductors					
					Adductors					
HALLUX					Flexor — metatarsophalangeal					HALLUX
					Flexor — interphalangeal					
					Extensor — interphalangeal					

Additional Data:

Face _____

Speech _____

Swallowing _____

Diaphragm _____

Intercostals _____

KEY

100%	5	N	Normal — Complete range of motion against gravity with full resistance.
75%	4	G	Good* — Complete range of motion against gravity with some resistance.
50%	3	F	Fair* — Complete range of motion against gravity.
25%	2	P	Poor* — Complete range of motion with gravity eliminated.
10%	1	T	Trace — Evidence of slight contractility. No joint motion.
0	0	0	Zero — No evidence of contractility.
	S or SS		Spasm — Spasm or severe spasm.
	C or CC		Contracture — Contracture or severe contracture.

*Muscle Spasm or contracture may limit range of motion. A question mark should be placed after the grading of a movement that is incomplete from this cause.

LEFT										RIGHT
					Examiner's Initials					
					Date					
SCAPULA					Abductor — Serratus anterior					SCAPULA
					Adductor — middle trapezius					
					Adductors — Rhomboids					
					Elevators					
					Depressor					
SHOULDER					Flexors					SHOULDER
					Extensors					
					Abductors					
					Horizontal Abductor					
					Horizontal Adductor					
					External rotators					
					Internal rotators					
ELBOW					Flexors					ELBOW
					Extensors					
FOREARM					Supinators					FOREARM
					Pronators					
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					Extensors — metacarpophalangeal.					
					Flexor — proximal interphalangeal					
					Flexor — distal interphalangeal					
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					Adductors					
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					Extensor — interphalangeal					
					Abductors					
					Adductor					
					MEASUREMENTS					
CHEST					Inspiration					CHEST
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ABDOMEN					Umbilicus to Ant. Sup. Spine					ABDOMEN
LOWER EXTREMITY					Circumference — mid calf					LOWER EXTREMITY
					Circumference — mid thigh					
					Ant. Sup. spine to int. malleolus					
					Umbilicus to internal malleolus					

Cannot walk Date_____ Walks with crutches Date_____

Stands Date_____ Walks with canes Date_____

Walks with braces Date_____ Walks unaided Date_____

Walks with corset Date_____ Climbs stairs Date_____

Other Apparatus_____

Scoliosis and other deformities_____

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Revised March 1946

FACTS and FIGURES about INFANTILE PARALYSIS

THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS, INC.

FRANKLIN D. ROOSEVELT, FOUNDER

The National Foundation for Infantile Paralysis
FRANKLIN DELANO ROOSEVELT, FOUNDER
120 Broadway, New York 5, New York
Fourth printing: Revised Dec. 1946

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PREFACE

AS PUBLIC health and medical workers you are undoubtedly familiar with the fact that an enormous amount of research is being carried on through grants made by the National Foundation for Infantile Paralysis. This is only a part of the coordinated effort to combat this disease. Other phases include a program of education for professional and lay people, epidemic aid, and care of poliomyelitis patients throughout the country.

There is a local chapter of the National Foundation in your area prepared to carry out the pledge that lack of funds shall not deprive any infantile paralysis patient of medical and hospital care, regardless of age, race, creed or color.

Basil O'Connor
President

PREFACE

AS PUBLIC health and medical workers you are undoubtedly familiar with the fact that an enormous amount of research is being carried on through grants made by the National Foundation for Infantile Paralysis. This is only a part of the coordinated effort to combat this disease. Other phases include a program of education for professional and lay people, epidemic aid, and care of poliomyelitis patients throughout the country.

There is a local chapter of the National Foundation in your area prepared to carry out the pledge that lack of funds shall not deprive any infantile paralysis patient of medical and hospital care, regardless of age, race, creed or color.

Basil O'Connor
President

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introduction

THIS publication was prepared in response to many requests for statistical information about infantile paralysis. The material chosen for presentation is elementary in character and is meant to answer questions of general interest. The aim has been to compile the most reliable figures available on the incidence and statistical characteristics of infantile paralysis in the United States.

Some limitations must be recognized in the interpretation of these data. "Cases reported" means only the cases which have come to the attention of health authorities. How close this comes to approximating the actual number of cases, no one knows. It is felt, however, that the diagnosis and reporting of cases of infantile paralysis has improved and is improving. The morbidity registration area has gradually grown, and during the last ten years official figures on the reported incidence of infantile paralysis have become available for most counties and cities in the United States. It must be kept in mind, however, that these figures are not always comparable. In some states only paralytic cases are reported, while in others non-paralytic cases are also included.

While sickness may not always be reported, it is only under extraordinary circumstances that a death is not registered. Mortality figures, therefore, may be considered reliable for all states since 1933 when the Registration Area for Deaths became complete. In many states mortality figures are reliable for a much longer period. The six New England States, as well as New York, New Jersey, Michigan and Indiana, have been in the Registration Area since 1900.

Another limitation in interpreting data dealing with infantile paralysis arises from the essentially local nature of manifestations of this disease. It is misleading to generalize on a nation-wide basis. "Epidemic year" does not refer to a national epidemic, but rather to a high incidence of infantile paralysis in an unusually large number of separate localities. Since reporting of infantile paralysis cases became widespread enough to allow comparisons, there has been no year, with the exception of 1938, when some community in the United States has not suffered an epidemic of this disease.

ALTHOUGH cases which were probably infantile paralysis were reported by Colmer as occurring sporadically in Louisiana in 1843 and by Taylor in 1867 in other sections of the country, the epidemic occurrence of the disease was first reported in the United States by Caverly who described the outbreak in the Otter Creek Valley of Vermont in 1894. During the succeeding decade scattered outbreaks of the disease were recognized and described. The first major epidemic centered around New York and the eastern seaboard states in 1916. Since that time recognition of the disease has become widespread. It is now realized that infantile paralysis is generally distributed throughout the country. Few communities are free from sporadic cases over any long period of time.

IN interpreting these data it must be kept in mind that generalizations from a large experience are useful, but that deviations from the expected pattern of behavior are the rule in localized outbreaks involving small population groups.

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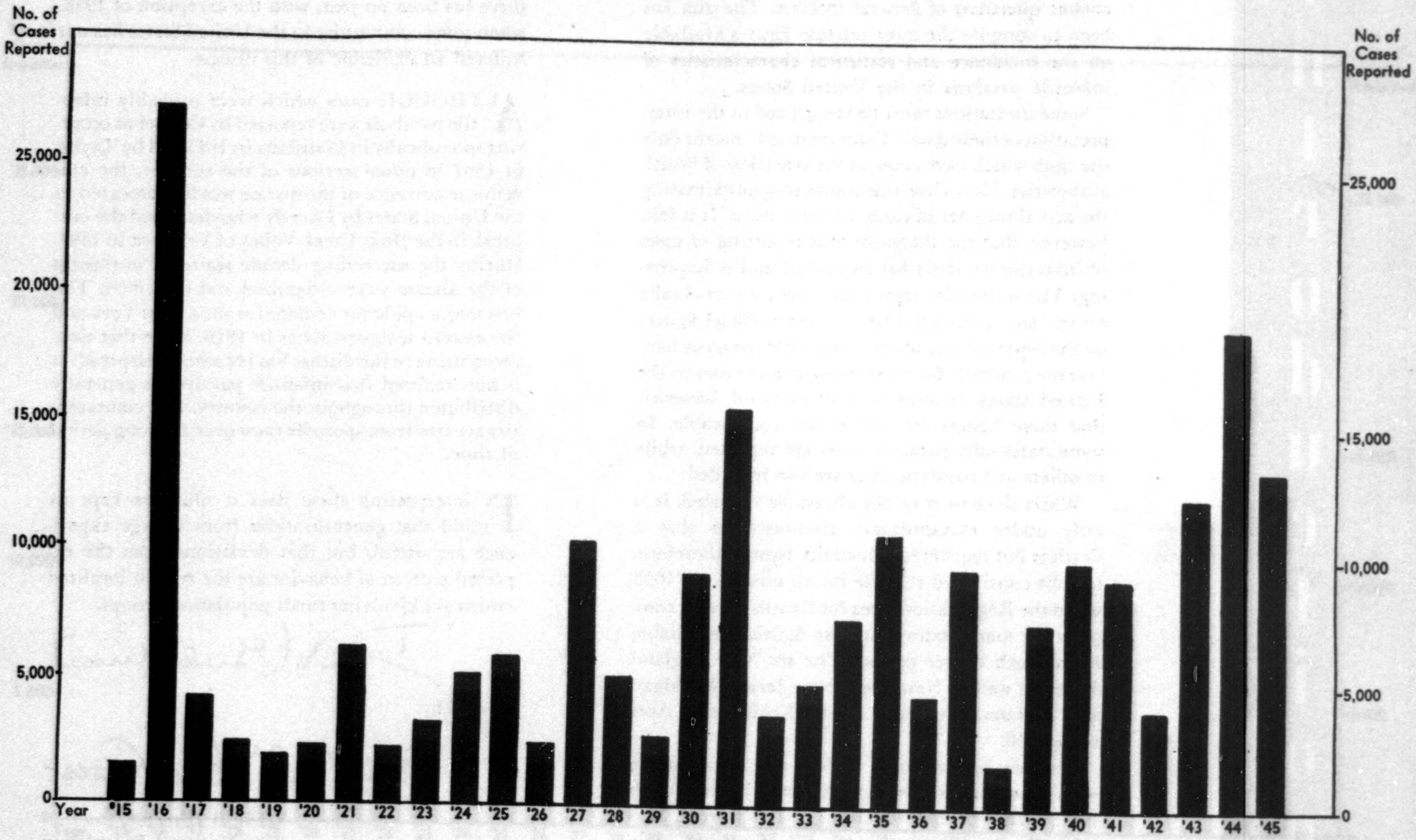
Revised by:

Hart E. Van Riper

Medical Director
The National Foundation for Infantile Paralysis

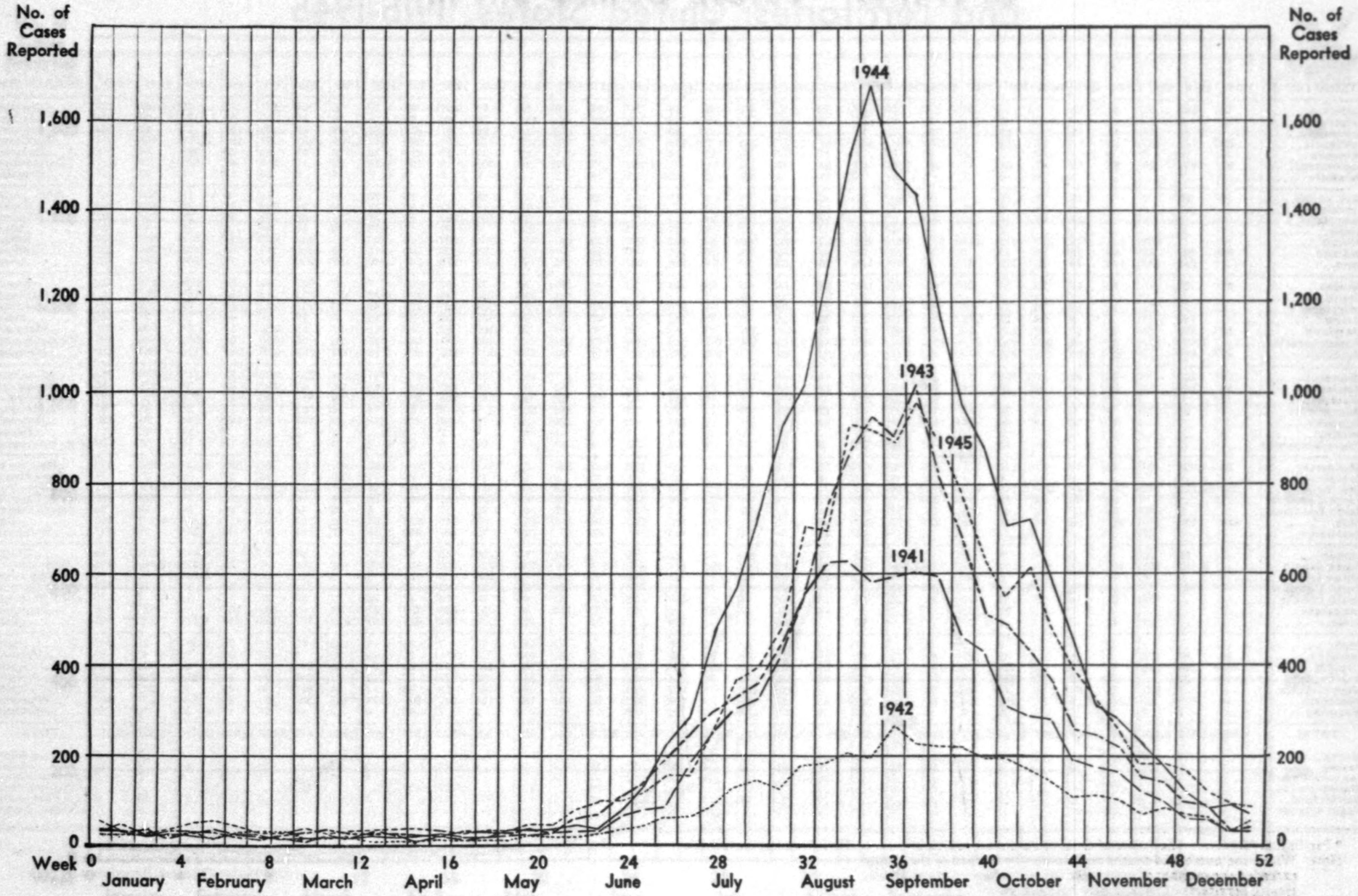
*Deceased

Chart 1—Infantile Paralysis Cases Reported in the United States—1915-1945



Data from the United States Public Health Service

Chart 2— Weekly Incidence of Infantile Paralysis in the United States—1941-1945



Data from the United States Public Health Service

Table 1—Cases of Infantile Paralysis Reported by States and Territories; United States, 1915-1945

STATE OR TERRITORY	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945*	STATE OR TERRITORY
Alabama	12	186	42	15	35	.....	.....	33	24	26	75	37	30	61	58	68	57	35	28	50	61	391	82	99	45	54	871	72	39	103	153	Alabama
Arizona	2	6	.....	.....	.....	.....	2	.....	3	3	37	4	72	.....	9	29	12	11	31	131	25	14	25	9	93	15	15	34	138	34	24	Arizona
Arkansas	.....	.....	14	14	11	.....	30	.....	18	.....	10	.....	61	.....	.....	80	.....	.....	13	20	28	57	341	34	49	29	59	151	77	44	63	Arkansas
California	62	132	67	75	27	72	282	63	250	192	821	187	1,277	298	172	1,835	292	191	170	3,338	829	389	690	117	1,006	461	241	197	2,698	486	938	California
Colorado	.....	16	8	9	.....	10	.....	12	8	8	.....	12	77	76	13	76	7	.....	7	20	22	33	218	13	138	40	26	39	289	64	146	Colorado
Connecticut	35	951	29	53	12	41	86	47	88	120	50	33	188	70	18	71	1,133	29	78	14	402	16	104	19	28	17	114	46	378	219	217	Connecticut
Delaware	.....	.....	.....	.....	.....	1	3	2	.....	.....	4	11	4	10	8	6	6	11	7	3	6	1	8	2	8	2	25	17	7	93	31	Delaware
Dist. of Col.	6	39	6	2	11	3	40	5	19	23	22	6	14	36	6	11	17	39	12	10	85	7	30	28	19	8	76	5	12	194	141	Dist. of Col.
Florida	.....	.....	.....	7	6	6	8	16	14	7	59	16	39	23	33	.....	17	.....	.....	16	16	42	35	32	66	34	263	43	28	108	144	Florida
Georgia	.....	.....	.....	.....	23	23	15	16	41	.....	.....	13	21	.....	24	.....	.....	42	41	48	36	157	92	71	106	30	798	49	28	104	123	Georgia
Idaho	.....	.....	.....	.....	.....	.....	38	.....	.....	11	10	7	39	47	15	18	15	9	9	156	6	21	15	12	36	66	10	6	15	15	24	Idaho
Illinois	.....	.....	853	303	273	287	678	134	217	257	262	127	480	106	82	402	700	203	207	214	244	689	780	106	192	583	375	487	1,576	560	1,098	Illinois
Indiana	36	207	69	68	32	29	80	.....	27	78	58	37	153	34	25	165	60	29	46	74	49	55	146	17	56	682	117	97	108	334	203	Indiana
Iowa	.....	259	157	176	14	32	170	21	.....	65	179	19	109	37	76	222	167	51	45	37	65	76	241	40	197	930	41	72	204	204	320	Iowa
Kansas	48	103	74	30	61	26	81	21	148	27	122	66	196	40	26	694	32	41	55	79	35	92	246	7	52	537	49	109	761	116	132	Kansas
Kentucky	.....	.....	.....	.....	.....	.....	.....	.....	22	.....	82	.....	195	59	.....	.....	.....	52	44	118	333	89	128	38	171	223	219	136	156	767	67	Kentucky
Louisiana	9	77	56	39	31	14	17	35	30	19	31	21	73	21	.....	310	33	43	31	27	104	35	138	45	20	131	73	63	72	159	129	Louisiana
Maine	.....	149	11	7	2	34	26	23	14	139	29	16	135	49	12	162	121	62	67	25	160	39	136	16	6	12	40	44	14	21	75	Maine
Maryland	66	352	89	90	111	47	221	39	27	192	50	46	31	289	21	43	50	35	44	28	107	37	82	18	27	15	238	17	24	508	107	Maryland
Massachusetts	.....	1,926	174	99	66	696	233	217	223	277	167	245	1,189	434	119	503	1,428	61	353	76	1,390	51	349	18	76	45	182	36	252	436	538	Massachusetts
Michigan	71	616	73	103	105	61	430	43	39	647	99	107	284	77	180	208	1,137	112	93	230	614	152	421	59	904	1,228	270	162	175	884	218	Michigan
Minnesota	127	909	75	82	85	80	706	51	81	144	929	44	140	224	33	473	822	123	377	113	99	37	355	47	564	258	303	83	111	560	243	Minnesota
Mississippi	85	269	56	57	76	66	49	21	43	25	47	49	56	59	28	46	54	33	14	35	16	138	351	69	26	43	157	63	36	129	80	Mississippi
Missouri	.....	.....	.....	.....	.....	.....	.....	.....	53	28	122	.....	273	33	19	259	83	20	40	37	52	105	393	26	29	314	40	87	210	187	297	Missouri
Montana	.....	94	37	8	9	25	26	47	16	183	41	12	22	65	7	20	58	9	13	322	7	12	31	14	6	108	33	13	26	39	81	Montana
Nebraska	.....	.....	.....	10	34	13	64	24	107	14	125	20	115	41	10	287	38	31	26	23	16	27	218	13	50	184	29	142	144	84	120	Nebraska
Nevada	3	.....	.....	.....	.....	.....	2	3	.....	17	27	.....	13	9	6	5	1	1	2	16	4	2	6	.....	2	2	.....	3	21	10	11	Nevada
New Hampshire	.....	.....	.....	.....	.....	16	12	12	6	40	21	6	51	21	8	26	73	7	14	7	67	5	25	3	4	3	46	12	14	68	30	New Hampshire
New Jersey	36	4,055	91	43	44	51	170	115	211	86	166	58	332	82	59	59	975	361	234	62	512	28	160	40	230	58	351	250	85	552	949	New Jersey
New Mexico	.....	.....	.....	.....	.....	3	6	7	2	6	12	8	200	19	.....	37	16	10	9	17	10	30	25	11	108	26	10	27	77	23	24	New Mexico
New York	257	13,223	295	233	146	214	1,149	610	943	1,210	793	674	916	1,021	495	738	6,189	334	1,386	222	2,866	194	636	115	1,041	223	1,100	291	675	6,091	1,812	New York
North Carolina	.....	.....	.....	22	43	24	36	30	25	.....	79	112	24	51	133	96	104	54	30	45	675	52	106	50	116	74	168	82	36	861	160	North Carolina
North Dakota	.....	.....	36	26	.....	9	44	16	23	72	154	24	27	138	19	44	43	30	82	11	12	17	7	8	18	46	20	21	24	53	15	North Dakota
Ohio	466	546	354	152	98	68	288	63	82	157	227	140	1,170	291	180	920	227	81	358	286	89	340	533	55	152	647	490	157	184	1,171	466	Ohio
Oklahoma	.....	.....	20	.....	.....	.....	.....	.....	.....	.....	38	32	157	38	.....	158	.....	24	.....	20	12	127	469	36	65	155	61	30	594	54	197	Oklahoma
Oregon	1	38	20	4	2	6	78	5	7	69	23	19	390	84	36	28	16	21	36	80	50	40	63	15	58	64	84	23	413	239	69	Oregon
Pennsylvania	.....	2,181	555	302	106	144	244	91	175	166	183	100	477	218	197	177	411	1,111	407	135	224	130	336	85	442	156	742	120	128	1,457	743	Pennsylvania
Rhode Island	.....	.....	9	12	2	18	5	105	7	18	37	12	65	15	11	23	169	10	20	2	359	4	21	7	6	16	37	6	189	13	9	Rhode Island
South Carolina	2	123	17	18	18	.....	.....	.....	.....	11	.....	.....	99	68	78	59	51	41	29	36	39	46	42	29	444	19	165	67	19	73	189	South Carolina
South Dakota	.....	.....	35	24	14	13	37	16	25	38	44	19	76	49	.....	147	36	15	37	45	16	13	37	28	32	84	28	15	15	8	20	South Dakota
Tennessee	.....	.....	.....	.....	.....	.....	30	22	.....	.....	.....	30	91	46	123	70	53	56	118	61	91	385	127	39	34	48	545	167	17	132	439	Tennessee
Texas	8	.....	21	46	.....	.....	.....	37	.....	.....	50	.....	266	.....	.....	134	.....	72	.....	152	79	68	637	63	232	187	123	243	1,274	238	995	Texas
Utah	.....	.....	.....	2	7	.....	9	.....	2	.....	11	.....	.....	23	8	6	.....	.....	23	15	11	7	33	3	105	62	41	25	399	25	253	Utah
Vermont	42	64	172	6	15	.....	63	24	43	13	81	21	36	49	38	18	111	23	51	10	73	11	38	13	33	9	22	36	28	42	59	Vermont
Virginia	241	330	269	82	143	76	131	78	147	127	94	67	72	97	325	119	68	63	38	83	688	68	68	59	46	241	155	44	61	756	338	Virginia
Washington	10	30	.....	24	16	10	336	18	22	592	115	16	292	343	31	51	86	84	90	741	46	77	87	18	27	449	74	33	352	205	327	Washington
West Virginia	.....	.....	332	30	61	16	43	12	24	24	17	.....	229	190	71	47	81	42	93	85	41	63	68	17	64	662	49	49	30	222	66	West Virginia
Wisconsin	14	475	57	268	226	84	259	81	54	68	313	44	177	55	22	178	722	55	64	137	66	47	292	38	106	504	97	45	206	274	607	Wisconsin
Wyoming	.....	7	1	2	2	3	3	8	4	.....	10	4	12	5	4	60	9	11	11	9	2	7	40	4	8	42	14	17	31	10	24	Wyoming
TOTAL	1,639	27,363	4,174	2,543	1,967	2,321	6,280	2,223	3,314	5,199	5,926	2,521	10,445	5,101	2,838	9,188	15,780	3,778	4,983	7,521	10,839	4,523	9,511	1,705	7,343	9,826	9,086	4,033	12,450	19,029	13,514	TOTAL
Alaska	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	.....	4	0	0	Alaska
Hawaii	.....	.....	.....	.....	.....	.....	3	1	10	13	3	1	29	5	4	17	27	16	7	14	4	43	8	10	65	55	34	5	64	4	15	Hawaii
Panama Can. Z.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	2	2	7	6	2	3	2	2	4	11	10	2	0	0	2	7	Panama Can. Z.
Philippine Isl.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	21	.....	.....	.....	25	24	.....	.....	127	.....	.....	.....	.....	.....	Philippine Isl.
Puerto Rico	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	.....	3	3	3	11	17	5	2	6	9	8	117	31	13	6	Puerto Rico
Virgin Islands	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	Virgin Islands

* Preliminary figures †Exclusive of cities of Panama and Colon .....No information available

Note: Where the number of deaths reported to the Bureau of the Census exceeded the number of cases reported to the United States Public Health Service, the former figure has been given.

Source: United States Public Health Service, *"Notifiable Diseases, Prevalence by States"*

Table II—Deaths from Infantile Paralysis Registered by States and Territories; United States, 1915-1944

STATE OR TERRITORY	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	STATE OR TERRITORY
Alabama	12	51	24	12	22	16	9	14	13	10	25	22	29	25	27	23	25	9	12	15	14	42	18	17	16	16	61	18	9	12	Alabama
Arizona	1	.....	.....	0	.....	.....	1	.....	.....	2	13	4	25	13	4	15	6	6	4	17	8	5	4	3	7	3	2	5	9	7	Arizona
Arkansas	.....	.....	14	14	11	14	29	18	13	8	9	16	32	18	12	25	26	16	11	6	8	19	87	16	13	17	13	12	8	5	Arkansas
California	23	27	28	20	9	28	54	26	42	37	149	36	230	74	43	155	51	35	15	109	67	37	82	16	76	47	19	27	170	39	California
Colorado	6	4	3	9	8	6	8	5	3	7	8	8	15	28	6	17	3	11	4	4	12	15	40	7	9	12	5	6	30	11	Colorado
Connecticut	12	239	17	10	8	17	25	16	9	22	19	5	16	14	7	15	97	9	3	3	25	7	12	0	3	3	3	3	*24	10	Connecticut
Delaware	.....	.....	.....	.....	3	0	0	0	3	3	1	0	2	7	3	0	2	2	1	0	1	1	1	1	2	2	1	1	0	6	Delaware
Dist. of Col.	2	6	2	.....	.....	1	8	0	3	2	3	3	3	4	1	4	3	6	2	3	11	2	4	1	2	5	4	1	2	12	Dist. of Col.
Florida	.....	.....	.....	7	6	6	3	8	7	4	18	12	8	8	8	14	8	6	7	3	7	6	5	7	9	7	34	4	6	9	Florida
Georgia	.....	.....	.....	.....	10	8	6	8	41	25	32	.....	21	20	27	30	27	10	29	19	34	24	21	17	14	37	13	10	14	Georgia
Idaho	.....	.....	.....	.....	.....	4	16	7	4	5	5	0	8	11	6	6	3	4	4	14	3	6	5	1	7	3	1	0	2	1	Idaho
Illinois	.....	.....	236	115	75	57	150	52	48	26	44	28	107	36	20	66	102	39	23	27	39	80	89	17	25	58	21	43	157	39	Illinois
Indiana	19	54	31	23	29	16	39	20	25	21	29	17	43	20	12	33	18	6	8	21	11	16	30	12	2	79	17	18	20	30	Indiana
Iowa	.....	51	63	42	14	5	119	6	21	16	42	12	28	14	22	32	40	17	14	9	7	12	41	8	31	64	5	8	18	16	Iowa
Kansas	20	25	18	11	20	10	35	12	29	9	35	14	44	7	8	66	13	11	12	11	9	10	34	2	6	41	9	19	68	10	Kansas
Kentucky	23	50	40	53	23	20	22	29	22	33	45	36	73	38	26	29	28	42	28	40	46	34	28	31	38	39	34	26	15	48	Kentucky
Louisiana	.....	18	56	13	11	14	5	12	17	11	18	13	33	14	11	49	18	11	11	4	13	8	19	9	8	15	8	8	8	12	Louisiana
Maine	6	28	5	7	2	9	17	6	7	13	10	7	22	15	6	28	11	7	7	5	14	3	17	3	0	4	3	4	1	3	Maine
Maryland	21	111	17	18	37	13	37	14	7	21	17	13	6	28	4	6	11	7	4	7	5	3	16	2	3	2	14	1	1	25	Maryland
Massachusetts	41	464	49	38	17	152	48	36	38	24	45	44	170	65	21	35	115	13	30	13	63	12	23	7	6	4	8	4	19	17	Massachusetts
Michigan	35	151	40	52	81	34	115	24	31	118	28	31	67	31	48	40	116	26	5	26	43	25	56	13	41	73	21	10	27	47	Michigan
Minnesota	30	106	19	32	18	18	95	20	15	26	140	12	31	59	6	40	69	10	38	20	12	5	51	11	60	23	37	6	10	37	Minnesota
Mississippi	.....	31	9	9	19	17	17	16	14	17	25	27	20	21	19	14	15	24	10	20	10	21	58	19	13	9	16	8	10	8	Mississippi
Missouri	40	48	49	31	36	30	58	20	30	20	55	20	81	24	14	41	25	10	14	16	17	22	76	14	16	39	12	15	36	13	Missouri
Montana	1	24	8	7	3	5	2	7	6	23	6	5	4	10	0	6	15	4	2	14	1	5	6	3	1	7	9	0	10	6	Montana
Nebraska	.....	.....	.....	8	3	10	29	5	25	8	40	18	21	8	10	45	12	10	5	8	11	11	46	7	9	22	10	24	*24	10	Nebraska
Nevada	1	.....	.....	.....	.....	.....	0	1	.....	5	14	.....	4	1	3	2	0	1	1	1	0	0	1	1	1	2	1	1	4	0	Nevada
New Hampshire	9	25	9	8	3	11	2	6	1	12	5	2	13	8	4	11	10	2	6	0	11	1	1	0	1	1	4	3	2	10	New Hampshire
New Jersey	24	1,209	41	16	15	19	50	29	42	25	33	17	43	27	12	16	142	47	22	13	35	10	20	10	26	6	21	25	12	56	New Jersey
New Mexico	.....	.....	.....	.....	.....	.....	.....	0	.....	0	.....	.....	.....	.....	6	13	5	9	1	6	4	7	7	4	7	4	2	7	8	4	New Mexico
New York	70	3,369	116	82	57	63	272	164	128	193	208	142	129	239	111	128	671	67	143	34	146	24	62	29	53	15	61	29	40	342	New York
North Carolina	.....	49	34	21	18	22	26	20	25	27	25	52	18	28	21	18	37	24	18	17	72	18	27	15	14	16	17	12	*16	40	North Carolina
North Dakota	.....	.....	6	8	7	1	1	7	2	18	42	5	12	17	9	10	8	3	9	4	3	3	2	1	1	2	2	4	2	2	North Dakota
Ohio	95	130	128	65	40	48	85	30	26	41	68	49	165	70	36	108	47	27	55	36	33	54	67	17	15	62	46	18	*16	88	Ohio
Oklahoma	.....	.....	9	10	17	15	21	47	10	8	28	18	55	31	33	40	19	20	28	20	10	36	72	18	10	22	15	15	34	8	Oklahoma
Oregon	.....	4	1	2	2	5	20	2	4	10	2	3	84	37	13	8	8	3	10	8	16	9	7	6	5	7	3	4	20	28	Oregon
Pennsylvania	85	668	142	103	48	50	83	38	66	44	67	44	100	72	51	46	96	144	53	31	31	22	44	17	53	32	62	24	19	117	Pennsylvania
Rhode Island	7	43	7	5	1	0	3	15	3	6	10	7	11	4	1	1	10	3	1	0	23	1	1	1	0	2	2	1	7	1	Rhode Island
South Carolina	.....	30	17	18	18	12	17	16	15	9	38	19	27	19	17	17	14	13	14	8	13	16	14	12	41	10	14	11	7	14	South Carolina
South Dakota	.....	.....	9	3	.....	8	6	1	6	7	12	7	21	16	8	11	13	8	4	10	6	1	7	2	4	5	3	2	1	3	South Dakota
Tennessee	.....	.....	28	33	20	18	30	22	27	23	35	29	39	39	34	30	22	19	34	34	27	44	30	20	12	6	42	28	7	16	Tennessee
Texas	.....	.....	21	35	.....	22	64	.....	124	27	32	47	127	57	43	63	48	64	47	73	49	35	127	42	55	40	48	50	167	51	Texas
Utah	3	3	1	2	3	1	5	4	1	1	0	5	22	8	3	1	6	4	3	3	1	1	9	0	7	6	1	2	26	0	Utah
Vermont	18	12	15	1	0	3	10	5	2	5	13	4	4	9	3	3	10	0	5	0	7	0	4	4	5	2	2	5	2	2	Vermont
Virginia	37	68	68	31	39	25	28	25	27	27	29	27	33	31	36	22	20	18	10	18	49	13	14	13	8	27	14	7	10	58	Virginia
Washington	7	11	7	7	10	4	122	8	11	104	34	7	65	55	11	10	16	11	16	54	7	16	8	4	7	36	16	7	29	19	Washington
West Virginia	.....	.....	38	.....	.....	.....	.....	0	0	13	14	9	44	40	17	11	23	14	19	19	12	21	21	15	8	59	14	11	3	24	West Virginia
Wisconsin	13	67	26	97	49	18	69	24	19	28	62	14	41	15	14	27	49	13	14	17	7	6	38	6	17	46	13	9	20	31	Wisconsin
Wyoming	.....	3	0	1	1	.....	1	2	1	1	0	1	1	0	4	0	3	0	0	2	2	1	6	2	3	10	0	2	5	0	Wyoming
TOTAL	661	7,179	1,451	1,079	813	855	1,862	847	1,013	1,145	1,632	911	2,176	1,436	854	1,427	2,139	882	797	852	1,040	780	1,461	487	773	1,026	807	561	1,151	1,361	TOTAL
Alaska	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	0	1	0	0	0	Alaska
Hawaii	.....	.....	.....	.....	.....	.....	.....	1	3	2	1	1	.....	1	2	3	3	2	3	2	0	1	2	2	5	5	5	0	0	0	Hawaii
Panama Can. Zone	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	1	0	2	0	0	0	1	0	2	†1	†0	0	0	0	0	Panama Can. Zone
Philippine Isl.	.....	.....	.....	.....	.....	.....	26	44	46	.....	13	6	7	7	8	.....	.....	18	11	24	16	15	10	16	.....	13	.....	.....	.....	.....	Philippine Isl.
Puerto Rico	.....	.....	.....	.....	.....	31	.....	.....	.....	.....	.....	1	.....	.....	3	.....	.....	3	1	0	1	2	8	2	5	3	3	7	4	3	Puerto Rico
Virgin Islands	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	Virgin Islands

* Civilian population only
..... No information available
† Exclusive of cities of Panama and Colon

Sources: United States Bureau of the Census,
"Vital Statistics, Special Reports"
United States Public Health Service,
"Notifiable Diseases, Prevalence by States"

Chart 3[A]—Distribution of Infantile Paralysis in the United States—1933

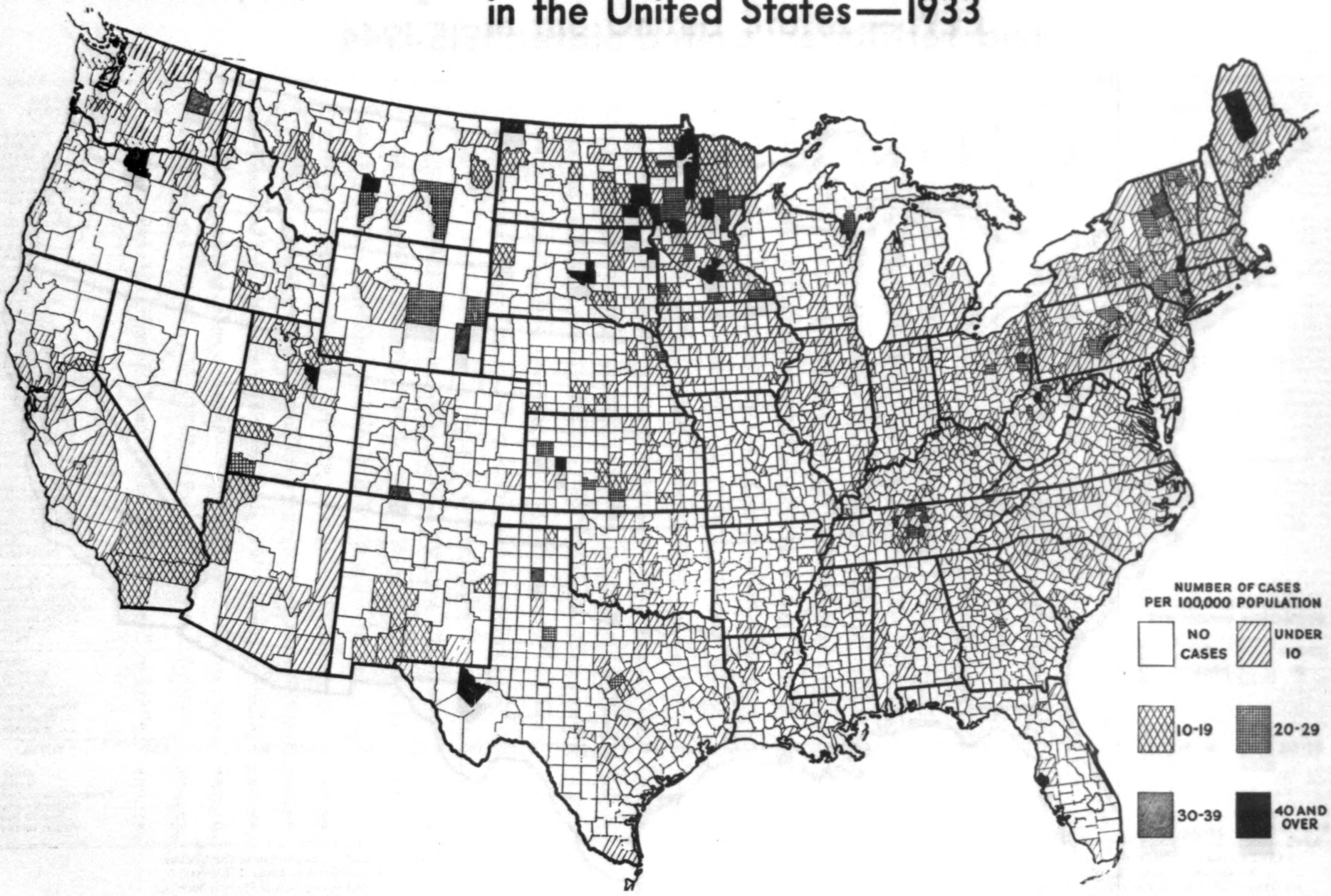


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Chart 3[B]—Distribution of Infantile Paralysis in the United States—1934

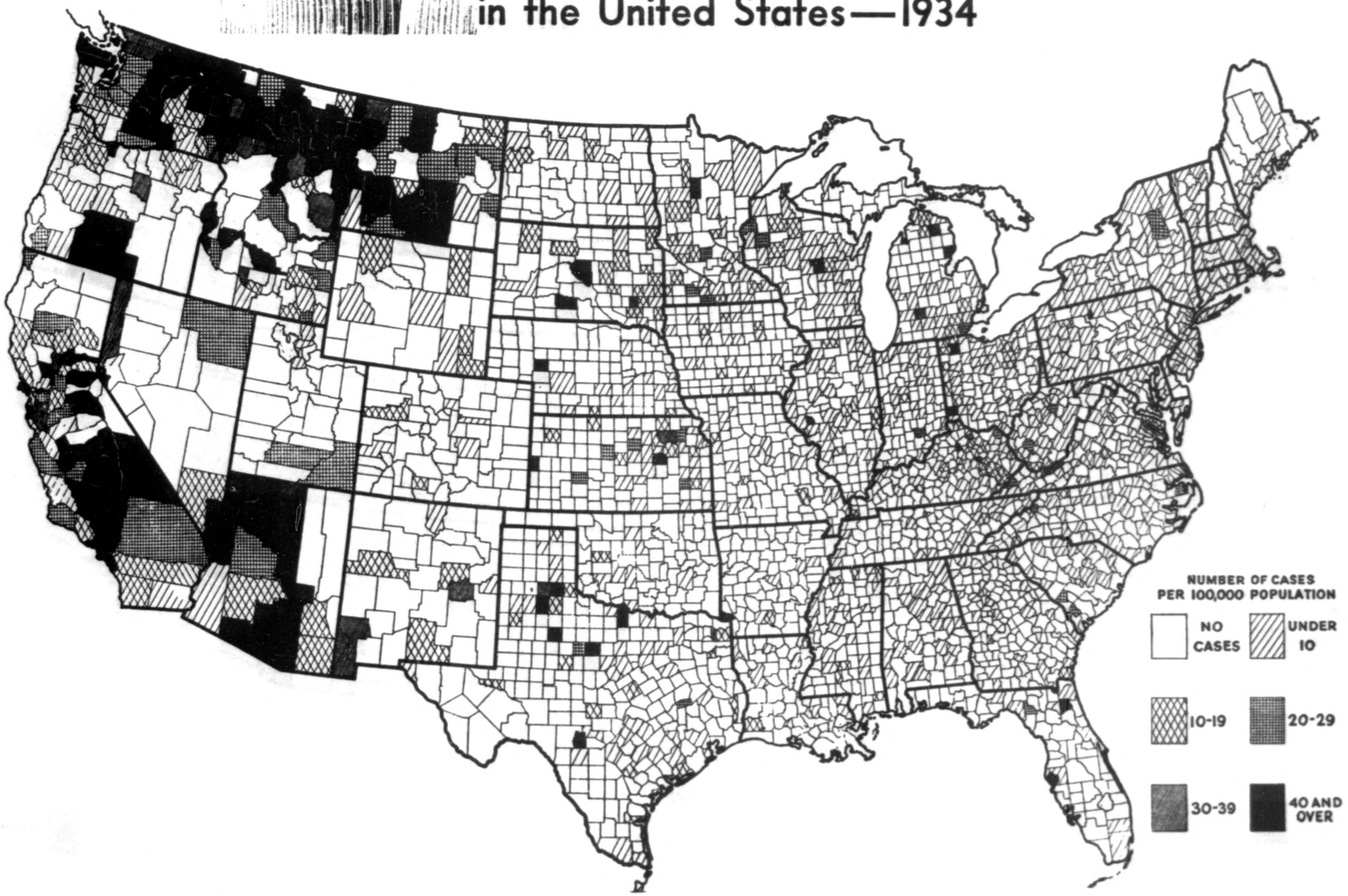

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Chart 3C—Distribution of Infantile Paralysis in the United States—1935

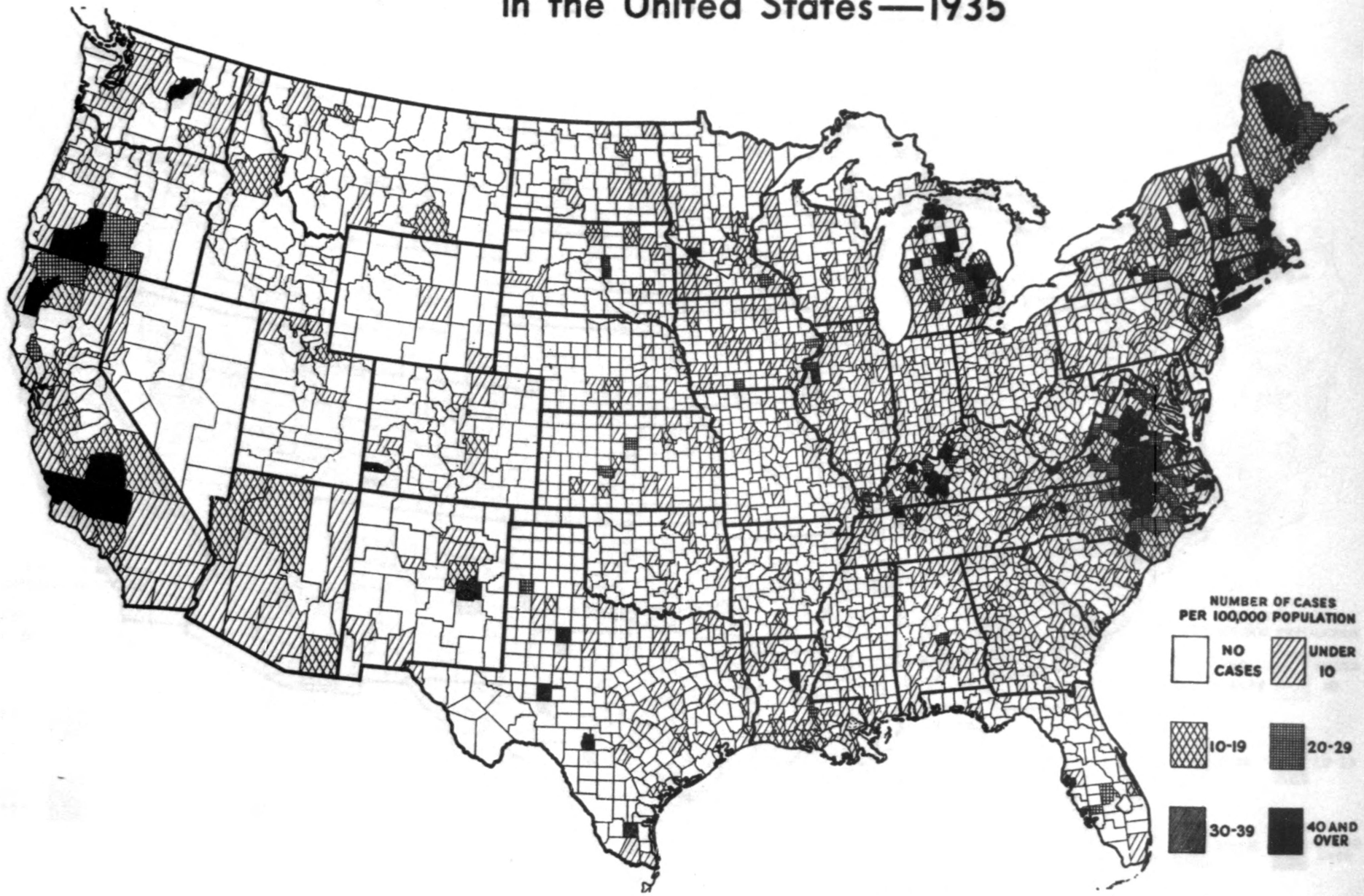

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Chart 3[D]—Distribution of Infantile Paralysis in the United States—1936

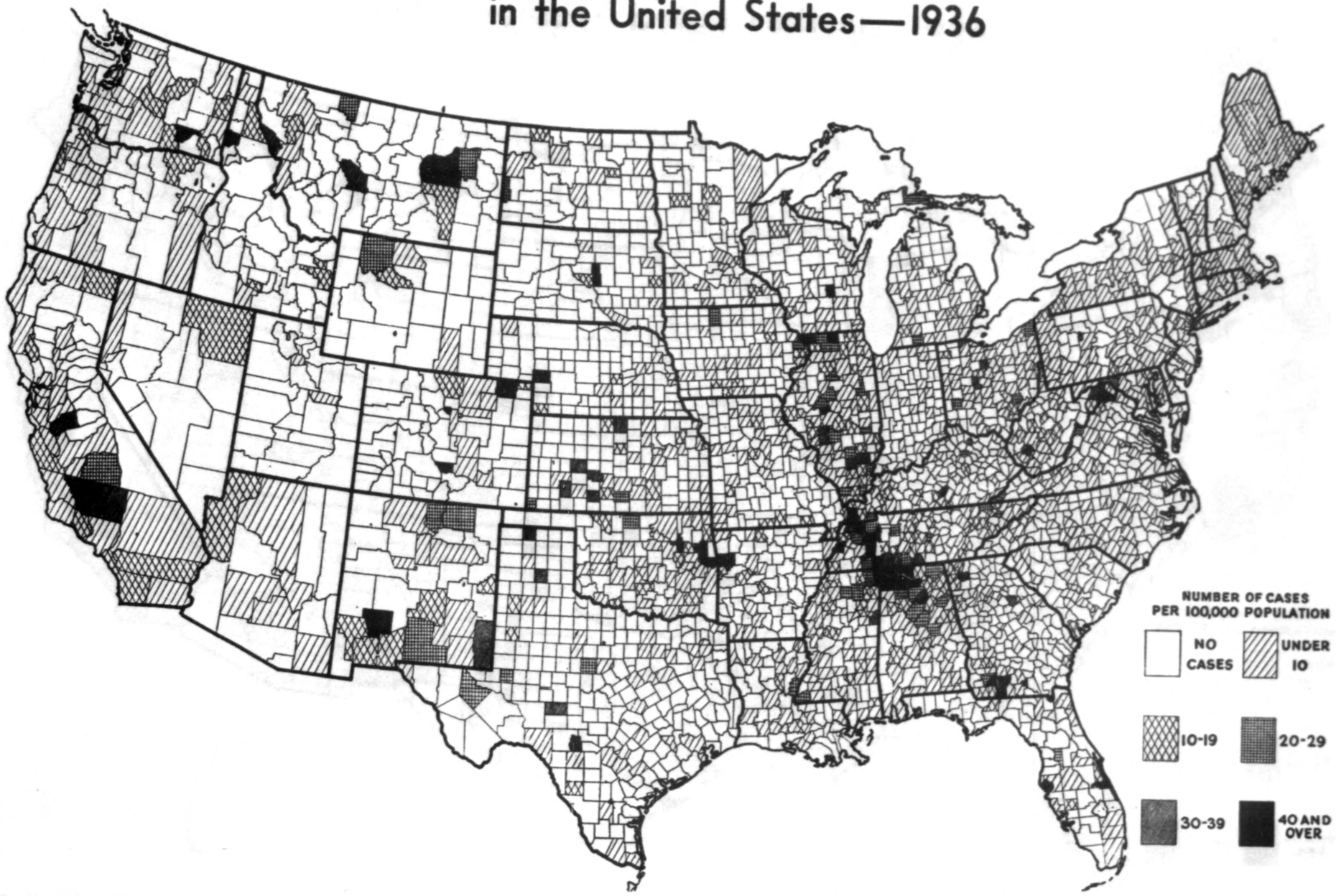

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Chart 3[E]—Distribution of Infantile Paralysis in the United States—1937

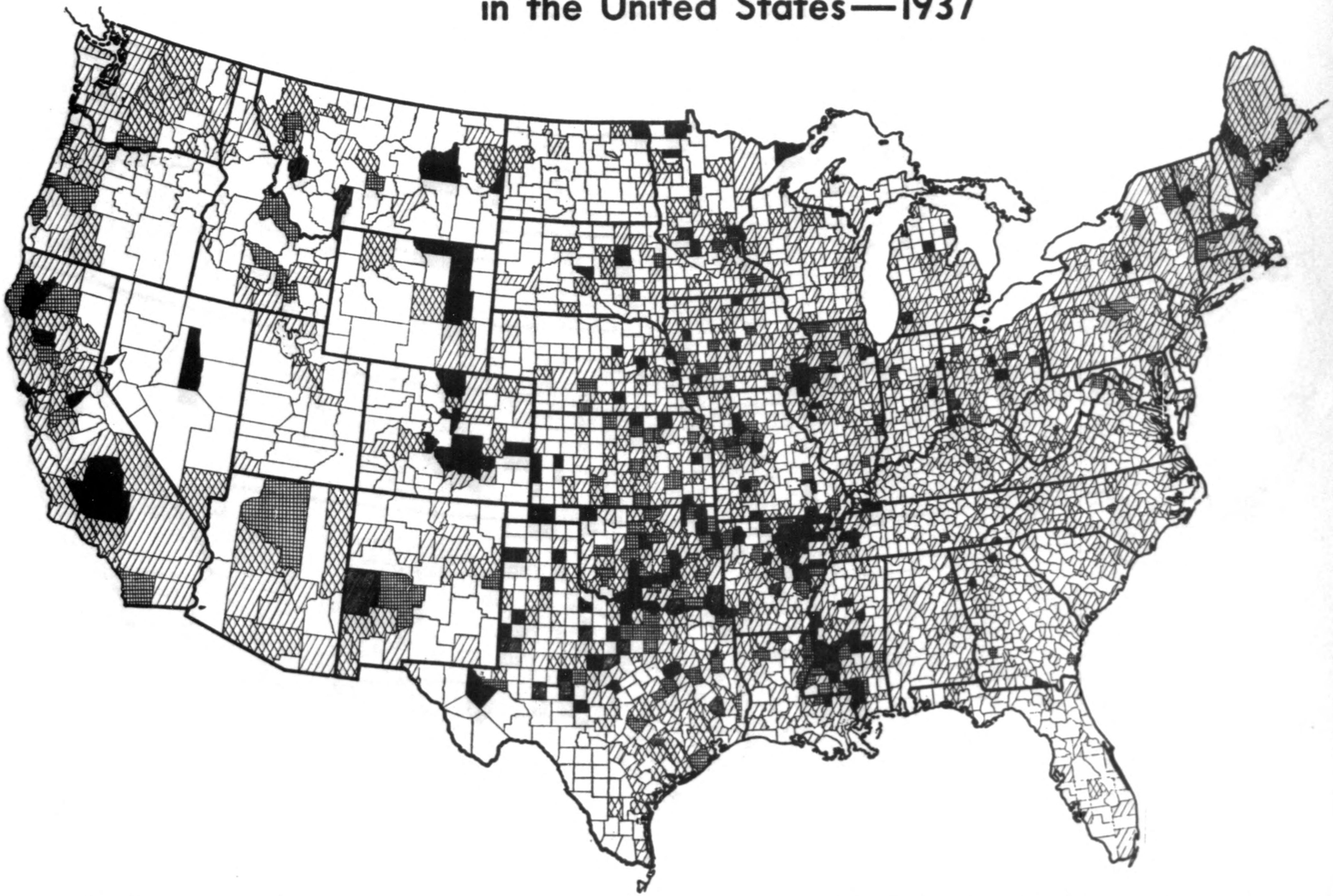

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Chart 3[F]—Distribution of Infantile Paralysis in the United States—1938

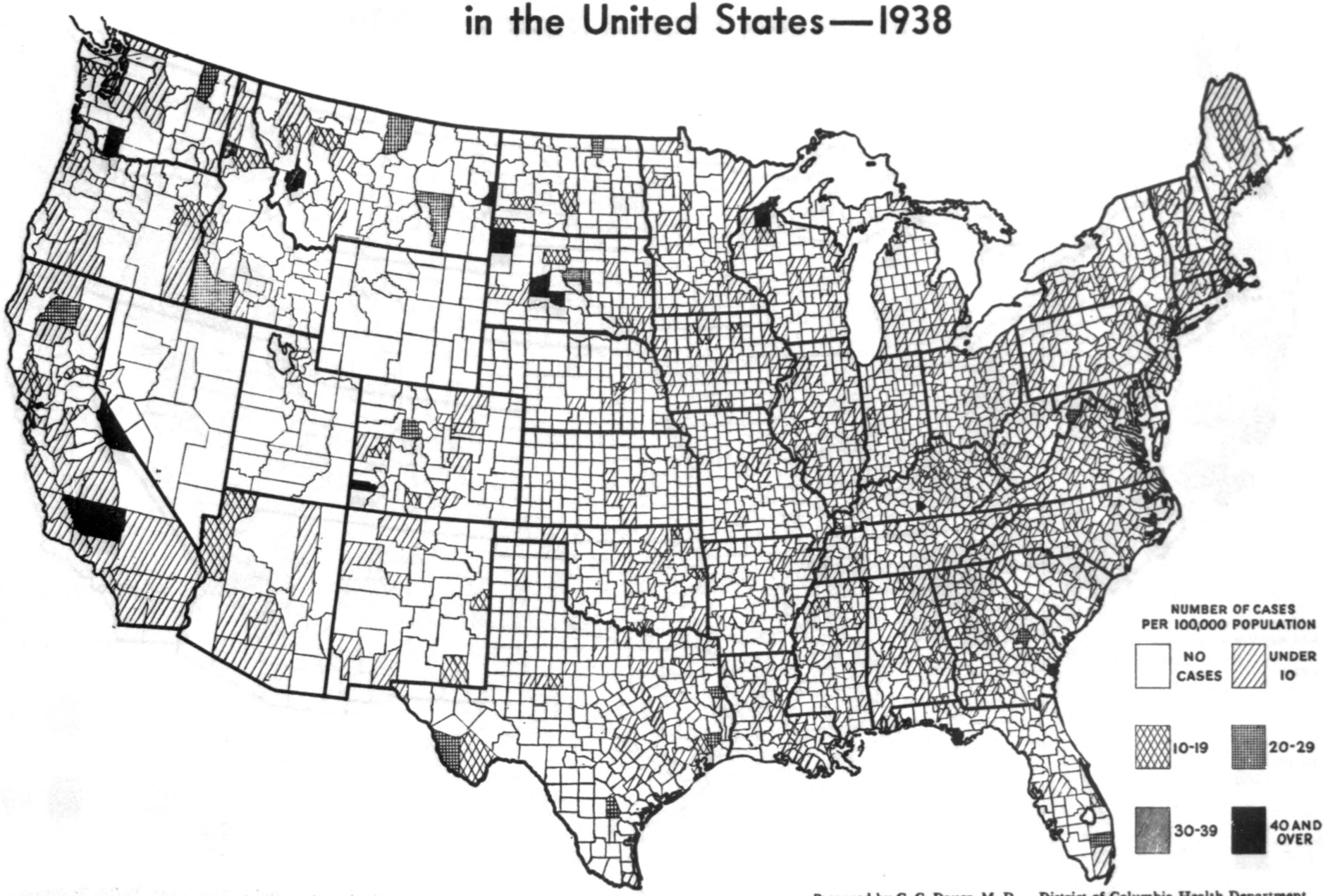

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Chart 3[G]—Distribution of Infantile Paralysis in the United States—1939

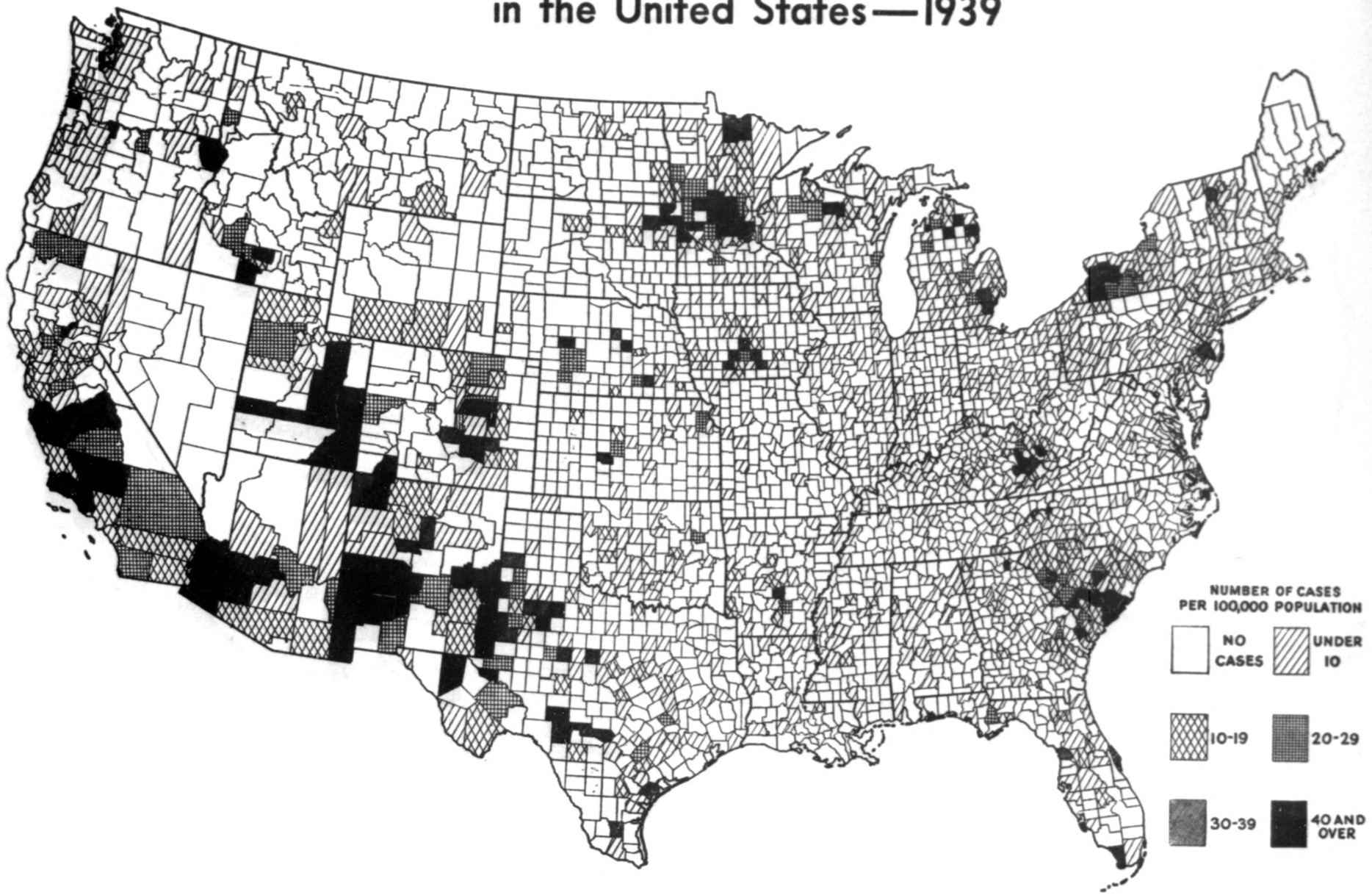

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Chart 3H—Distribution of Infantile Paralysis in the United States—1940

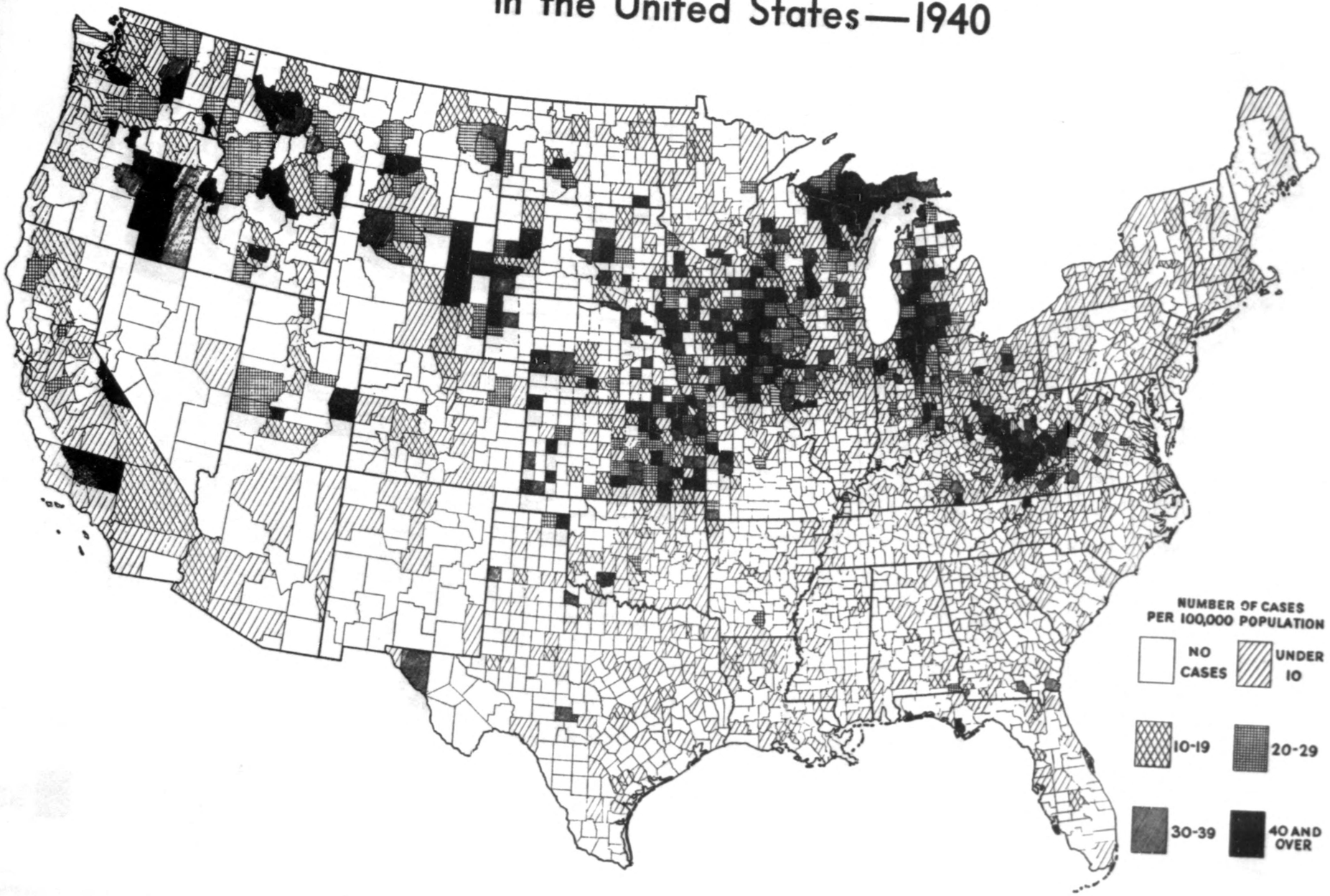

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Chart 3'—Distribution of Infantile Paralysis in the United States—1941

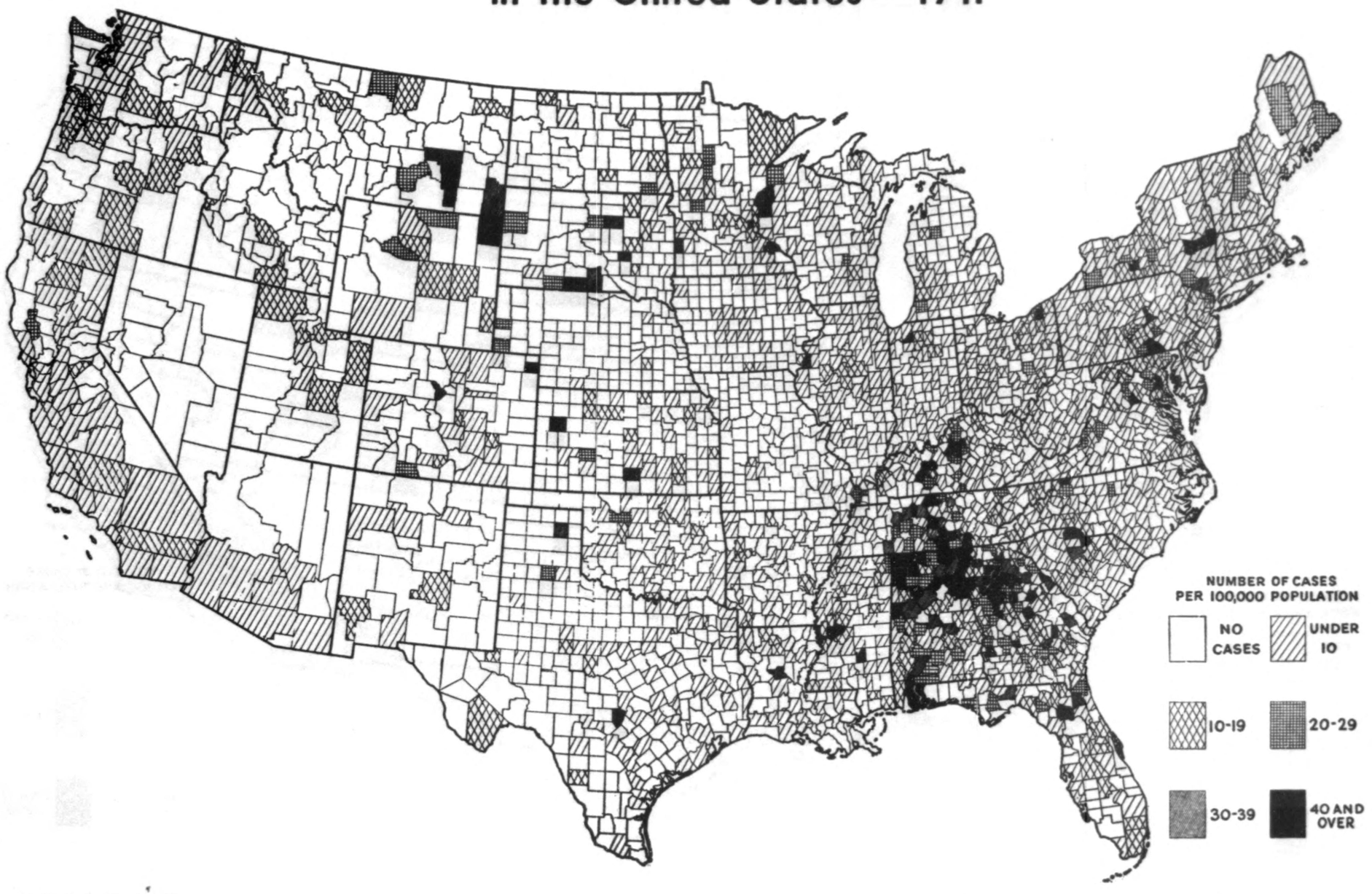

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Chart 3[J]—Distribution of Infantile Paralysis in the United States—1942

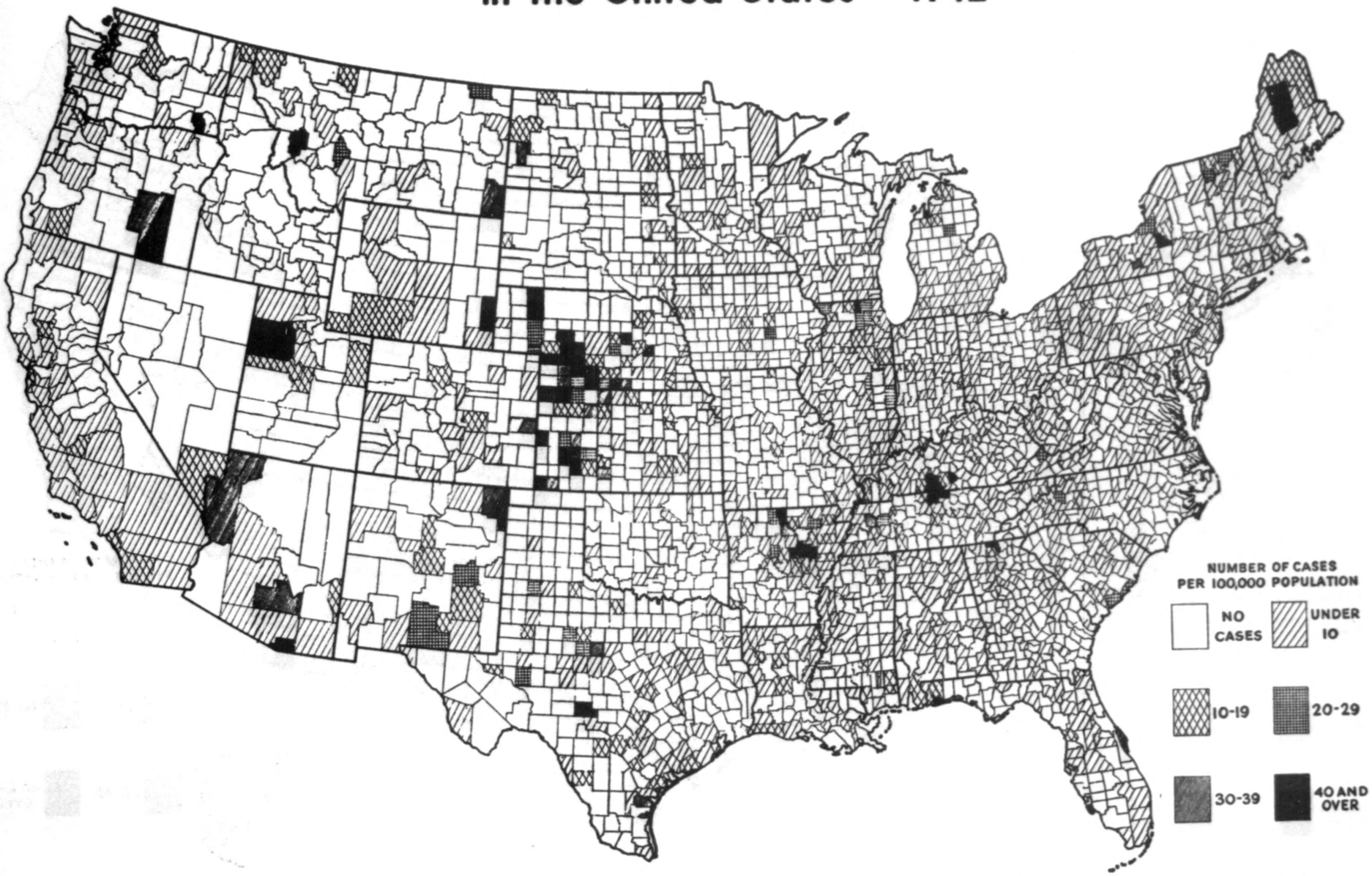

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Chart 3[K]—Distribution of Infantile Paralysis in the United States—1943

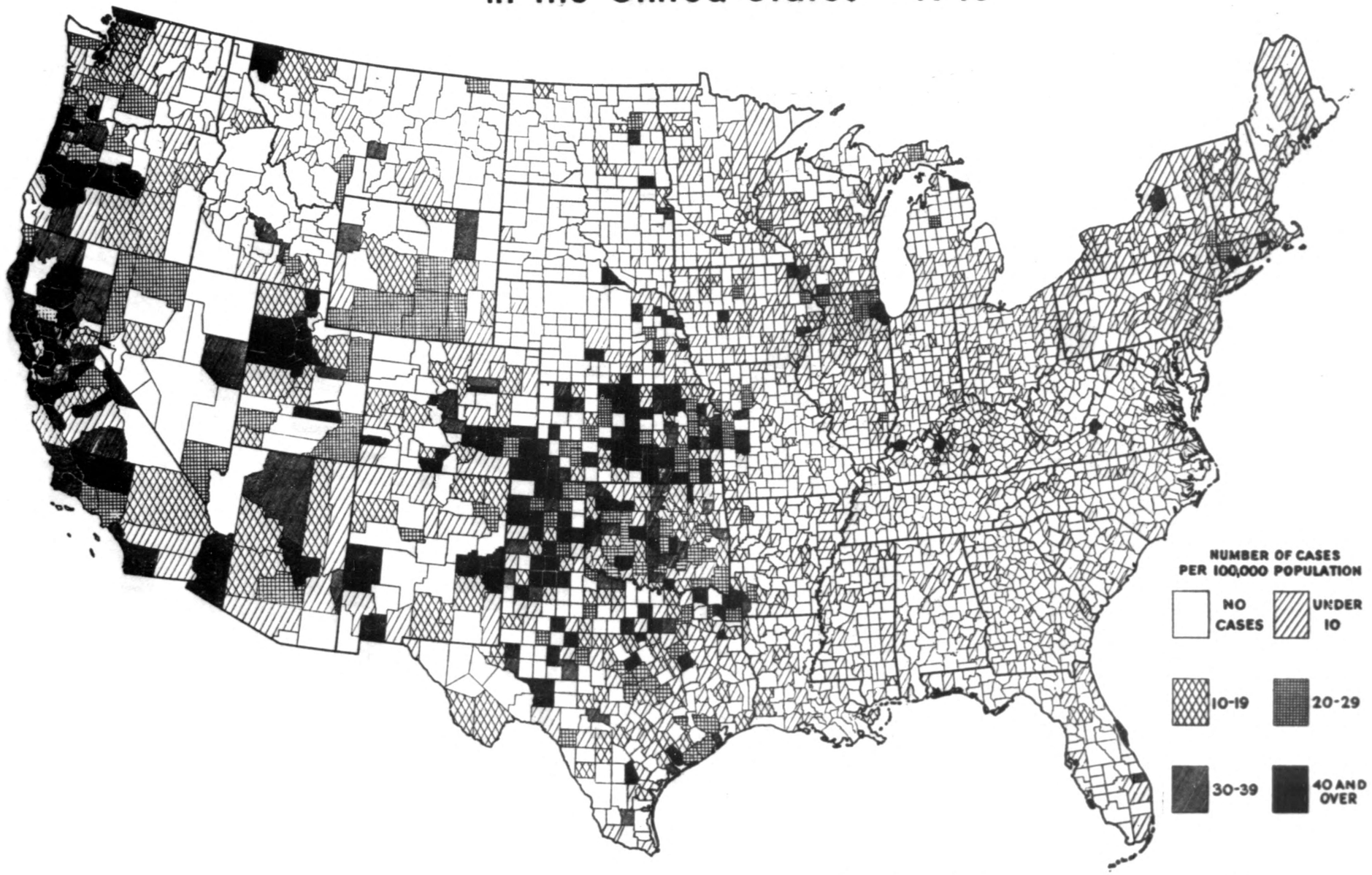

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Chart 3[L]—Distribution of Infantile Paralysis in the United States—1944

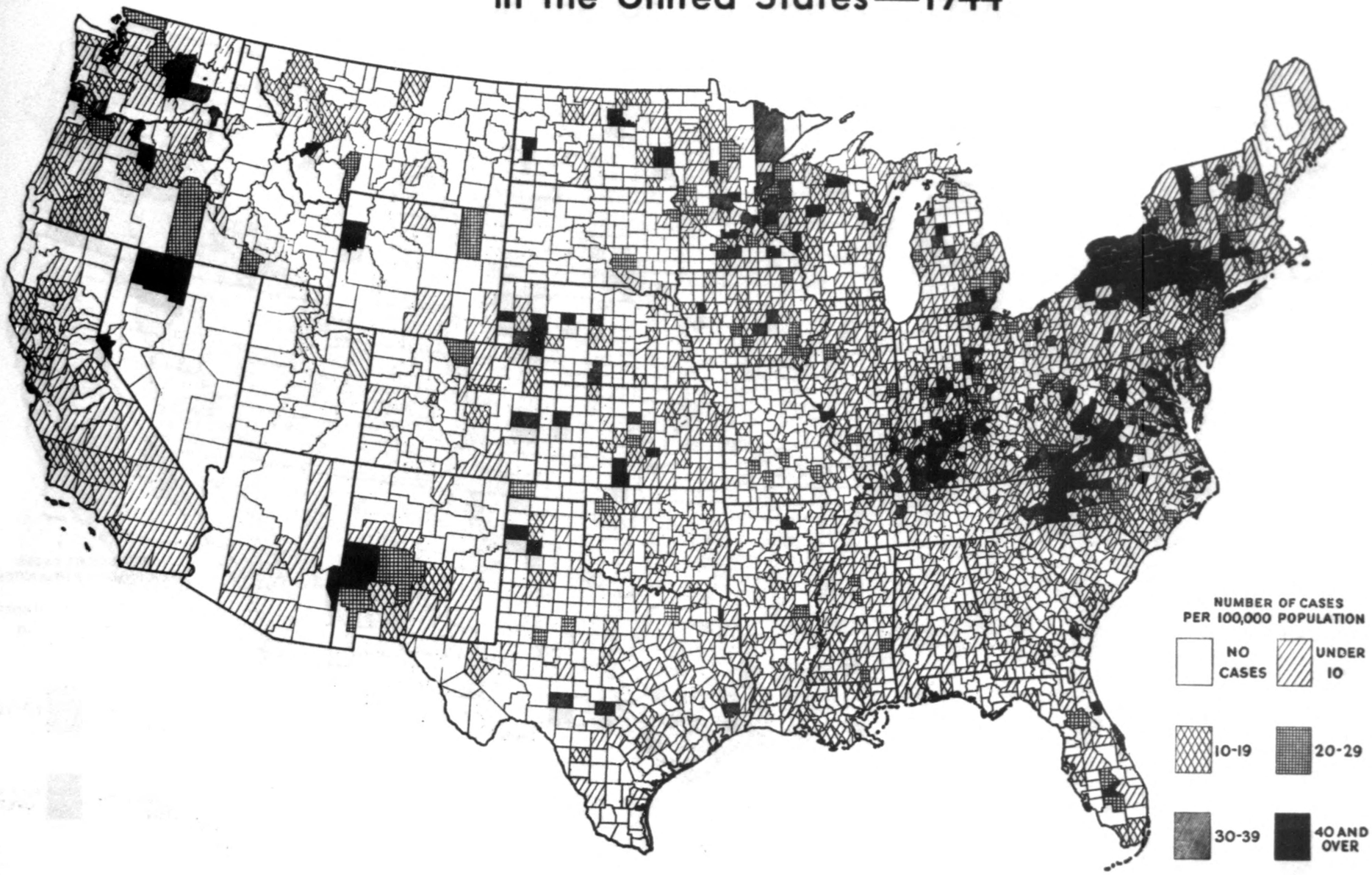

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Chart 3M—Distribution of Infantile Paralysis in the United States—1945

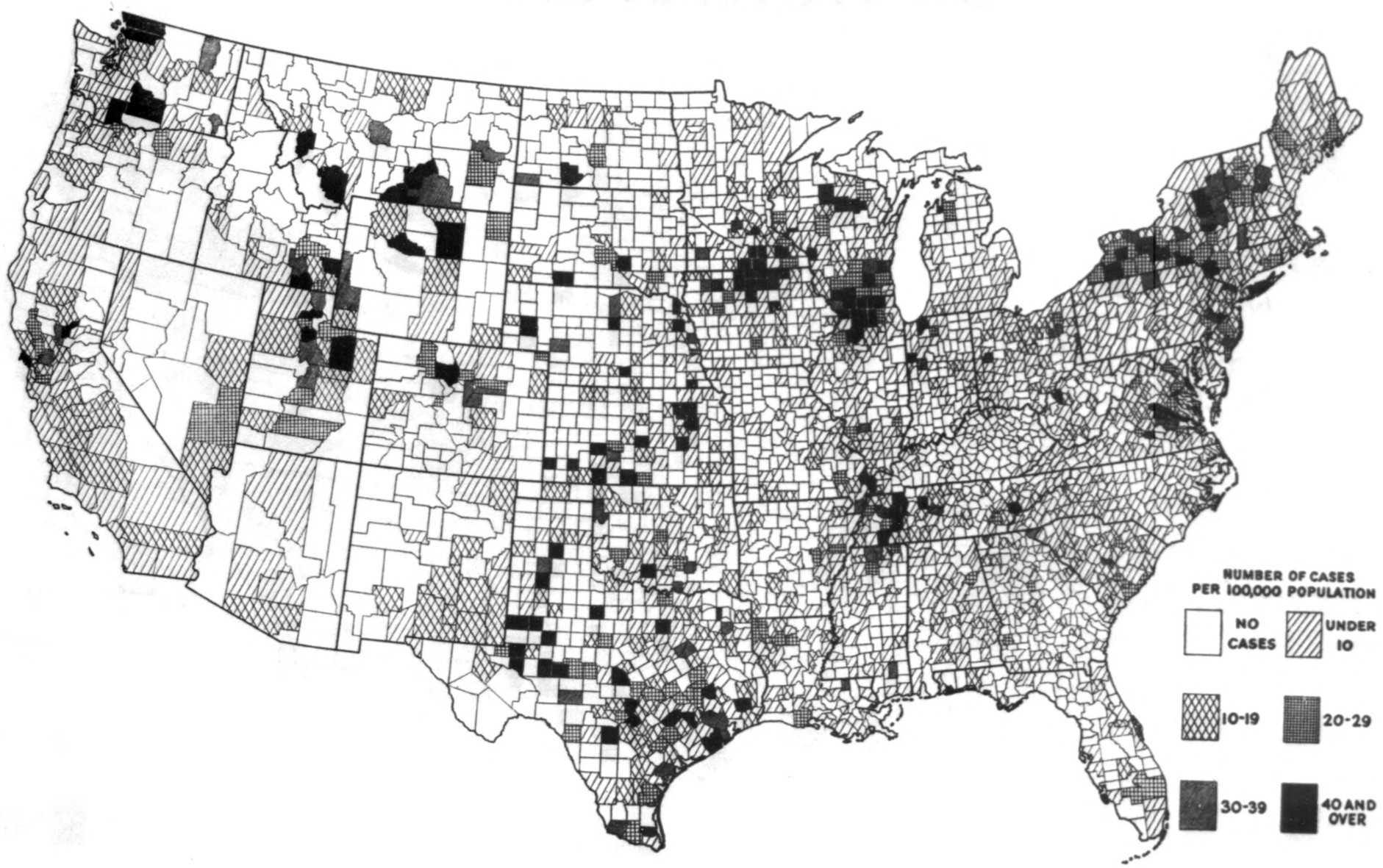

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Table III—Cases of Infantile Paralysis Reported by States for Three Ten-Year Periods; United States, 1916-1945

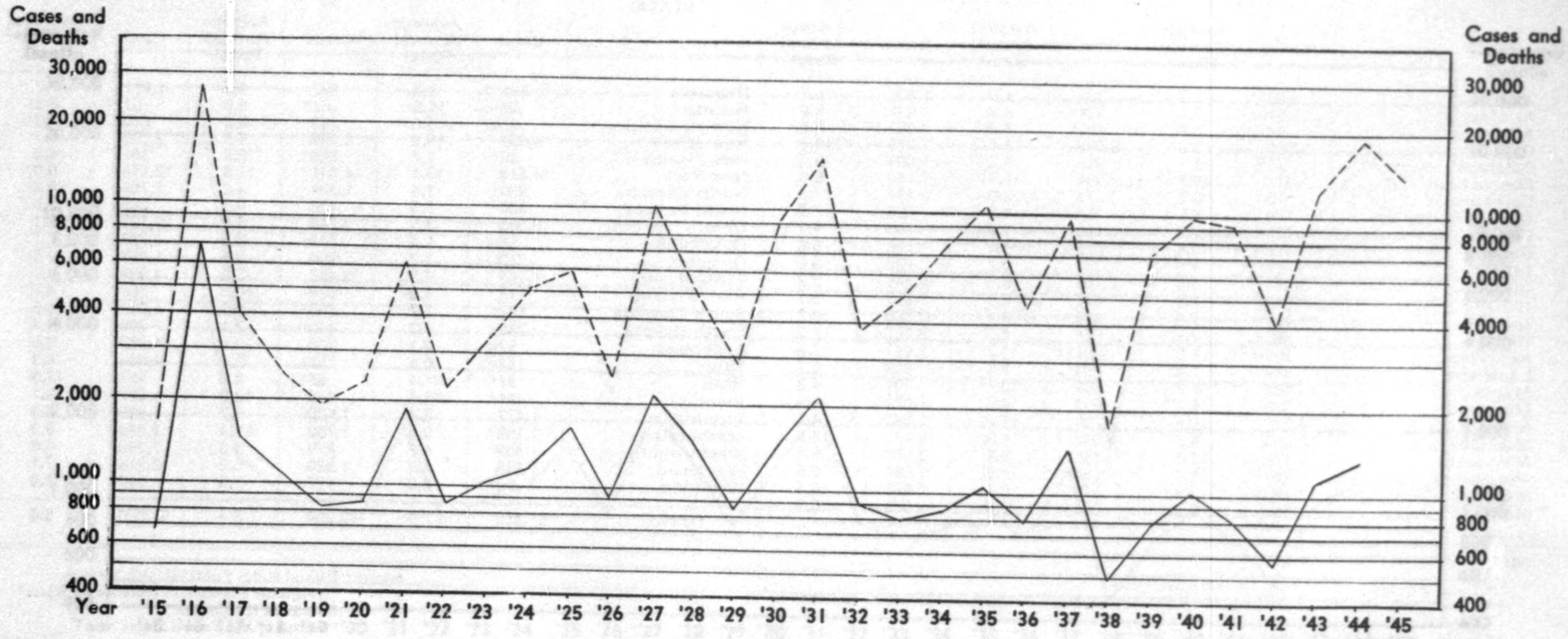
STATE	1916-1925		1926-1935		1936-1945	
	Cases	Average Annual Rate[1]	Cases	Average Annual Rate[1]	Cases	Average Annual Rate[1]
Alabama	436**	2.3	485	1.8	1,909	6.7
Arizona	51x	3.1	324*	8.3	401	8.0
Arkansas	97††	0.9	202x	2.2	904	4.6
California	1,981	5.8	8,589	15.1	7,223	10.5
Colorado	71†	1.1	310*	3.3	1,006	9.0
Connecticut	1,477	10.7	2,036	12.7	1,158	6.8
Delaware	10xx	0.7	72	3.0	194	7.3
Dist. of Columbia	170	3.9	236	4.8	520	7.8
Florida	123**	1.6	160†	1.6	795	4.2
Georgia	118xx	0.8	225†	1.1	1,558	5.0
Idaho	59a	4.6	321	7.2	220	4.2
Illinois	3,264*	5.6	2,765	3.6	6,446	8.2
Indiana	648*	2.5	672	2.1	1,815	5.3
Iowa	1,073*	5.0	828	3.4	2,325	9.2
Kansas	693	3.9	1,264	6.7	2,101	11.7
Kentucky	104aa	2.2	801††	5.1	1,994	7.0
Louisiana	349	1.9	663*	3.5	865	3.7
Maine	434	5.7	809	10.1	403	4.8
Maryland	1,218	8.4	694	4.3	1,073	5.9
Massachusetts	4,078	10.6	5,798	13.6	1,983	4.6
Michigan	2,266	6.2	3,042	6.3	4,473	8.5
Minnesota	3,142	13.2	2,448	9.5	2,561	9.2
Mississippi	709	4.0	390	1.9	1,092	5.0
Missouri	203a	2.0	816*	2.5	1,688	4.5
Montana	486	8.9	535	10.0	363	6.5
Nebraska	391**	3.8	607	4.4	1,011	7.7
Nevada	49xx	15.8	57*	6.9	57**	6.5
New Hampshire	107††	4.0	230	6.0	210	4.3
New Jersey	5,032	15.9	2,734	6.8	2,703	6.5
New Mexico	36††	1.7	326*	8.6	361	6.8
New York	18,816	18.1	14,841	11.8	12,178	9.0
North Carolina	259†	1.4	1,324	4.2	1,705	4.8
North Dakota	380**	7.3	430	6.3	229	3.6
Ohio	2,035	3.5	3,742	5.6	4,195	6.1
Okiahoma	58aa	1.4	441†	2.6	1,788	7.7
Oregon	252	3.2	760	8.0	1,068	9.8
Pennsylvania	4,147	4.8	3,457	3.6	4,339	4.4
Rhode Island	213*	3.9	686	10.0	308	4.3
South Carolina	187x	2.2	500*	3.2	1,093	5.8
South Dakota	246*	4.3	440*	7.1	280	4.4
Tennessee	62aa	1.1	739	2.8	1,933	6.6
Texas	154xx	0.8	703x	2.4	4,060	6.3
Utah	31x	1.4	86††	2.8	953	17.3
Vermont	481*	15.2	430	12.0	291	8.1
Virginia	1,477	6.4	1,620	6.7	1,836	6.9
Washington	1,163*	9.5	1,780	11.4	1,649	9.5
West Virginia	559*	4.2	879	5.6	1,290	6.8
Wisconsin	1,885	7.2	1,520	5.2	2,216	7.1
Wyoming	40*	2.3	127	5.6	197	7.9
TOTAL	61,310	7.5	72,994	6.4	91,020	6.9

* 1 year omitted
** 2 years omitted
† 3 years omitted
†† 4 years omitted
x 5 years omitted
xx 6 years omitted
a 7 years omitted
aa 8 years omitted

[1] per 100,000 population
Rates are based on United States Censuses of 1920, 1930, and 1940

Source: United States Public Health Service, *"Notifiable Diseases, Prevalence by States"*
Bureau of the Census, *"Census of the United States"*

Chart 4—Infantile Paralysis Cases Reported and Deaths Registered United States, 1915-1945



Cases _ _ _ _
Deaths ____ _

Data from the United States Public Health Service and the United States Bureau of the Census

Table IV—Infantile Paralysis Compared with Other Childhood Diseases—United States, 1933-1943

	INFANTILE PARALYSIS			DIPHTHERIA			WHOOPING COUGH			MEASLES			MUMPS			CHICKEN POX		
	Cases	Deaths	No. of Cases Reported for each Death Registered	Cases	Deaths	No. of Cases Reported for each Death Registered	Cases	Deaths	No. of Cases Reported for each Death Registered	Cases	Deaths	No. of Cases Reported for each Death Registered	Cases	Deaths	No. of Cases Reported for each Death Registered	Cases	Deaths	No. of Cases Reported for each Death Registered
1933	4,983	797	6	50,462	4,937	10	179,135	4,463	40	400,894	2,813	143	91,467	55	1,663	253,532	162	1,565
1934	7,521	852	9	43,156	4,159	10	265,269	7,518	35	799,455	6,986	114	104,789	75	1,397	258,306	177	1,459
1935	10,839	1,040	10	39,226	3,901	10	180,518	4,753	38	743,856	3,907	190	156,656	85	1,843	273,863	165	1,660
1936	4,523	780	6	30,018	3,065	10	147,237	2,666	55	299,493	1,267	236	207,013	102	2,030	226,120	134	1,687
1937	9,511	1,461	7	28,536	2,637	11	214,652	4,981	43	321,510	1,501	214	153,380	60	2,556	281,107	116	2,423
1938	1,705	487	4	30,508	2,556	12	227,319	4,773	48	822,811	3,296	250	153,967	68	2,264	286,843	104	2,758
1939	7,343	773	9	24,053	1,997	12	183,188	3,026	61	403,317	1,174	344	131,826	87	1,515	258,746	110	2,352
1940	9,826	1,026	10	15,536	1,457	11	183,866	2,926	63	291,162	706	412	118,374	104	1,138	280,300	88	3,185
1941	9,086	807	11	17,987	1,293	14	222,202	3,785	59	894,134	2,279	392	199,609	111	1,798	299,580	94	3,187
1942	4,033	561	7	16,260	1,273	13	191,383	2,536	75	547,393	1,302	420	287,150	168	1,709	303,107	104	2,914
1943	12,450	1,151	11	14,811	1,196	12	191,890	3,368	57	633,627	1,301	487	203,046	99	2,051	304,203	111	2,741

Sources: United States Bureau of the Census,
"Vital Statistics, Special Reports" and *"Mortality Statistics"*
United States Public Health Service,
"Notifiable Diseases, Prevalence by States"

Table V—Infantile Paralysis by Age, Sex and Color
Chicago and Detroit, 1939-1944

AGE GROUP	WHITE			NEGRO			TOTAL			AVERAGE YEARLY CASE RATE**
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
Under 5 years	346	261	607	36	39	75	382	300	682	34.4
5- 9 years	613	373	986	53	28	81	666	401	1,067	54.8
10-14 years	387	277	664	16	14	30	403	291	694	30.4
15-19 years	166	100	266	11	7	18	177	107	284	11.5
20-24 years*	26	61	87	0	3	3	26	64	90	3.3
25-34 years*	46	58	104	2	1	3	48	59	107	2.0
35-44 years	14	9	23	2	0	2	16	9	25	0.5
45-64 years	2	3	5	0	1	1	2	4	6	0.1
65 years and over	0	0	0	0	0	0	0	0	0	0
Unknown	1	2	3	0	0	0	1	2	3	—
Total	1,601	1,144	2,745	120	93	213	1,721	1,237	2,958	

* 1939 figures for Chicago did not list the 20-24 and the 25-34 age groups separately. Therefore the total was divided into the same proportions as the other years.
** Per 100,000 population, based on the 1940 United States Census

Sources: Chicago Board of Health
and Detroit Department of Health