substitute for mother's milk. We want simplicity in food and method of preparation rather than complexity and artificiality.

We are ready to abandon wholesaling and turn our best attention to individualization. Wholesale sterilization or pasteurization is not much advocated in this, the twentieth century. Laboratory milk is not so much heard of now in the foreground of pediatric teachings. Sterilized or pasteurized milk is first class in specific instances and to meet special indications, but falls short of being the best at our command for all infants and all conditions.

The relative value of recognized methods of feeding infants as esteemed by leading pediatric specialists at home and abroad, in the writer's estimation, may be summed up in the following order:

1. Exclusive breast nursing.
2. Mixed feeding, the infant having the advantage of more or less breast milk daily whenever and so long as this is possible:
3. Cow's milk modified in the home, water, lime water or a simple demulcent being employed as a diluent.
4. Dispensary and commercially pasteurized milk.
5. Boiled top milk variously diluted to suit the infant's needs.
6. Whole cow's milk modified by admixture of one of the artificial foods.
7. Condensed milk and the several cereal and milk foods.

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INFANT DIGESTIVE DISTURBANCES.*

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Infancy and childhood are the periods of life in which digestive disorders are most prevalent and fatal. In children of all ages a transient form may occur at any season, with a decided predilection, however, for the heated term. In midwinter occasional attacks of more or less severe, although usually transient, diarrhea without fatal tendency are seen. It is in the three summer months that enteric disorders, with diarrhea as a common symptom, are most fatal. This clinical fact is so well recognized, indeed, that the term summer diarrhea has gained a prominent place in the nosology of early life.

The mortality among infants and children during the summer months from digestive disorders exceeds that from all other diseases during the same period. Comparative statistics show that the greatest susceptibility to summer diarrhea is found between the ages of 6 to 18 months, during which time the death rate from this cause is manifold that seen at any other age. The well-known mother's dread of the second summer is a clinical recognition of this fact.

The death rate seems to divide this subject into two classes, viz., early infancy and late infancy. It is a common clinical observation that the persistency of digestive disturbance, due to the introduction of an irritant, diminishes with the age of the child after two years. So that with increasing age there is a steady diminution in the severity of diarrheal disorders and a corresponding decrease in mortality from this cause.

The first class includes infants during the milk-feeding period up to about the middle of the second year,

while the second includes infants from 18 to 36 months. After the latter age, severe attacks of diarrhea are so infrequent as rarely to require the attendance of a physician.

In these disorders the onset is sometimes sudden, ushered in by a convulsion, vomiting and diarrhea. There is usually high temperature, thirst and nausea which make the infant clutch at food, but push it quickly aside as soon as a few mouthfuls have been swallowed. Restlessness is nearly always present. The stools may change suddenly, or there may be an interval of two or three days of preceding departure from the normal in frequency and character. There may be a great deal of colicky pain.

The infant, while apparently in perfect health, may develop vomiting, the matter ejected being at first the contents of the stomach little changed, highly acid, or densely curdled, to be followed soon, however, by a watery mucoid and sometimes by bile-stained fluid, less acid or even alkaline in reaction. Diarrhea frequently accompanies and invariably follows the onset of the disturbance. The first dejections may be nearly normal, but quickly change, showing evidence of fermentation and later of putrefaction, finally becoming serous. The odor of the stool varies from the normal acid to intensely fecal and later to a sickening, musty smell. The infant, apparently well nourished and playful, quickly shows signs of systemic disturbance in fretful, peevish irritability and restlessness, with head rocking, anxious facies, persistent whining cry, pyrexia, dry mouth, softened, flabby tissues and atonic musculature. The depressed fontanelle, sunken, lusterless eyes, sharply defined temporals, drawn features, with the intense thirst give evidence of the great drain of fluids. The abdomen, at first tympanitic, may soon become flabby and depressed, and the extremities may be cold, although the rectal temperature shows from 103 to 106 degrees. Convulsions may usher in the attack, follow the initial vomiting by a few hours, appear only at the final stage or occasionally may not develop. Within twenty-four hours from the onset, and frequently earlier, the algid stage is reached, with pallor and cold superficialities, although the internal temperature may be high. The restlessness changes to a sopor accompanied by hyperesthesia and irritability when disturbed, but rapidly subsides into semi-coma, with shallow breathing, collapsed veins, pulseless radials, half-closed, filmy eyes and terminates in death by convulsion or asthenia.

This picture presents symptoms of acute poisoning from the gastro-enteric tract, occurring in a state of apparent perfect health, with fatal termination in from 24 to 48 hours. Although the well-nourished infant is not exempt from this form of acute intoxication, it occurs with so much greater frequency among those who show evidence of malnutrition that the latter condition may well be considered a predisposing cause.

Fortunately, cholera infantum, as just presented, with its almost invariable fatal termination, is by no means common. As to its frequency, it is extremely interesting to note the varying opinions of the most competent observers. One eminent observer of wide experience in diseases of children, stated recently in a public address that he had seen only three cases of undoubted cholera infantum. Other writers of equal eminence speak of its occurrence as more common and claim occasional success for certain therapeutic measures adopted in certain cases. These widely different opinions as to the frequency and fatality of cholera infantum may be reconciled only on the ground that we

* Read at the Fifty-fourth Annual Session of the American Medical Association, in the Section on Diseases of Children, and approved for publication by the Executive Committee: Drs. H. M. McClanahan, A. C. Cotton and H. E. Tuley.

have no common standard for the diagnosis of this grave disorder. The prevailing opinion seems to be that so-called cholera infantum is extremely rare and almost invariably fatal, and against which no therapeutic procedure has thus far proved efficient.

So far as antemortem clinical evidence goes, cholera infantum may be considered an intense form of acute gastroenteritis or a dyspeptic diarrhea plus some unknown intoxication.

Clinically, the line can not be sharply drawn between some cases of dyspeptic diarrhea and cholera infantum. It is within every clinician's experience that occasional cases presenting all the symptoms of so-called cholera infantum, from the sudden onset of vomiting to the serous diarrhea, seem to yield to treatment and ultimately recover. Who shall say that these were not cases of cholera infantum? Is there not a tendency to restrict that diagnosis to fatal cases only? Symptomatically the differentiation between the various forms of "summer complaint" can not be made. That bacteriology promises an early solution to some of these questions is believed by many, and the attention of the profession is turned with renewed interest to the special work of Booker, Flexner, Duval, Bassett and others in their investigation along this line.

The commonest form of summer diarrhea is so evidently the result of acute indigestion that some writers have classified it separately as the dyspeptic variety. This classification seems justifiable when we recall the frequent history of the ingestion of substances known to be inimical to normal digestion. In many other cases which give no record of dietetic error we are led to conclude by analogy of onset, symptoms and progress that perverted or disturbed digestion from causes not apparent may be responsible for a large proportion of summer diarrheas. It is the common experience of every physician to meet cases of sudden onset of vomiting and diarrhea, with temperature varying from slight elevation to a high degree of pyrexia, with or without *history* of improper feeding in which relief with absolute recovery follows the exhibition of one or more doses of castor oil and the withdrawal of food for 24 hours.

The diagnosis of diarrhea due to acute indigestion seems in the majority of cases to meet all the pathologic and therapeutic requirements. Unfortunately, however, in many instances, the simple treatment outlined above is not applied, or if applied, fails to secure the desired results, and the case develops a most obstinate form of gastrointestinal disturbance. There is continuation of pyrexia, with colicky pains, more or less flatulence, frequent dejections of foul, acid, greenish stools of varying consistency. The vomiting may cease, but the diarrhea persists with increasing tenesmus, the stools becoming mucoid, bloody or serous, and either fetid or odorless. From the common onset the resultant disorder may be named according to the area apparently most involved, as gastroenteritis, enterocolitis, ileocolitis or colitis with or without proctitis. It is amply in evidence that obstinate enteritis with or without anatomic change in the mucosa of the gut, or even membranous or ulcerative colitis, may be the last expression of an acute attack of indigestion in the infant.

The systemic disturbance which seems to be an expression of intoxication from the stomach and bowels varies widely as the disorder locates with greater or less intensity on this or that portion of the digestive tract. The early cessation of vomiting is frequently accompanied by the subsidence of pyrexia, with im-

provement in the general muscular tone. Apparently systemic disturbance diminishes proportionately with the distance from the stomach at which the burden of the disorder seems to fall. Thus, in most obstinate cases of colitis with extensive lesions of the mucosa, nutrition is frequently maintained to a remarkable degree, the child showing but little evidence of systemic intoxication, whereas a much less obstinate disorder of the small intestine may cause prostration with symptoms of general infection. In other words, the more active the digestive area involved the more profound the constitutional disturbance and the greater the tendency to prostration and collapse.

Of the complications of summer diarrhea, the most common in young infants is stomatitis from simple catarrhal to the obstinate ulcerative variety. It becomes serious as it interferes with the ingestion of food and increases the restlessness and discomfort. Its persistency adds to the gravity of the prognosis. This complication is most often seen where the gastric disturbance is marked, and its improvement is usually in direct ratio with the improvement in stomach digestion.

Cough and rapid respiration, so frequently seen in acute or subacute gastroenteric disorders, is usually indicative of broncho-pneumonia, which may or may not yield marked physical signs. That it selects the most dependent portion of the lung adds to this infection the dangers of mechanical hypostasis.

The quite frequent occurrence of albuminuria in patients with summer diarrhea has led some observers to attribute the convulsions to uremia and the occasional so-called idiopathic edema to nephritis. The conclusions, however, are rarely confirmed by the postmortem findings. Functional cardiovascular conditions with the anemia rapidly induced by the colliquative discharges appear a rational explanation for many of the cerebral phenomena and the edemas of dependent parts.

Lesions of the integument, from mere dryness or ordinary intertrigo to the various forms of urticaria, furunculosis and local necrosis, are met with most frequently in the subacute and chronic diarrheal disorders. Whatever the local treatment applied they yield only to the improved nutrition of convalescence.

A prolonged digestive disturbance rarely leaves the infant free from evidences of retarded development, which in many instances is never fully compensated. The picture of a two-year-old set back to the plane of a yearling, both as to digestive and motor functions, is a familiar one, and the attempt to adapt his hygiene to age instead of to condition is a common error.

Perhaps the most important effect of severe summer complaint on the survivors is the feeble resistance to infection from lowered vitality, so that the danger from intercurrent diseases is manifold. The special hygiene for these little convalescents is a subject too frequently dismissed with the doctor at the conclusion of the enteric disorder.

It is safe to say that the fatalities of summer diarrheas are seen very rarely among the exclusively breast-fed infants. They may starve to death from insufficient or impoverished breast milk, or dying from inherited dyscrasias they may show some of the symptoms of chronic indigestion. They may exhibit symptoms of acute or subacute digestive disturbance as a result of palpable errors in hygiene or they may be destroyed by some overwhelming intoxication, presumably due to sudden changes in the constitution of the breast milk, resultant from physical or mental disturbance in the nurse. In none of these instances is the symptom

diarrhea essentially a summer diarrhea. Moreover, it is a common observation that the diarrheas of the exclusively breast-fed are usually tractable, regardless of season, in otherwise healthy infants, by the application of the well-known principles of hygiene.

The startling mortality from digestive disorders is confined almost entirely to bottle-fed babies. This fact is so generally established that when pronounced diarrheal symptoms appear in an infant at the breast the first interrogations are directed towards the possibility of the ingestion of other material than breast milk. A careful study of the infant's hygiene, with examination of the dejecta after colonic flushings, frequently disproves the statement that the child's diet included nothing but breast milk. Statistics show that in the fatal cases of summer diarrhea less than 3 per cent. were exclusively breast fed. No clinical phase of this subject begins to rival in importance this one fact, that summer diarrhea, with rare exceptions, means practically summer artificial feeding.

In view of our knowledge of summer diarrhea the question of feeding, then, is of paramount importance. A neglect to use every means to secure for the infant natural food can not be atoned for by the most energetic therapy yet devised. Many of the obstacles to natural feeding are insuperable or even formidable only so long as the lay mind is asleep to the fact that his physician knows how to prevent fatal digestive disorders in the infant. When the responsibility for the consigning of a baby to a method of feeding that diminishes his chances of living two-fold more than inoculation with smallpox virus is fully brought home to the physician the difficulties of breast feeding will become proportionately insignificant. The fact that some governments and municipalities now require on the infant's death certificate a statement as to the method of feeding shows an awakening to the importance of this matter. How long before the same line of inquiry shall require an explanation as to why the infant was subjected to the manifold dangers of artificial feeding?

It has long been claimed, partly from inference and latterly as a result of milk examinations, that breast milk is not constant in its composition, but varies normally, not only in the total amount of solids, but also in their relative percentages. The admirable work of many milk analysts, especially that of the Adriances, shows some of these variations in solids during the entire period of lactation in quite a large number of recorded cases. So far as I can learn, however, no extensive record has been kept as to the influences of season on the various constituents of the mammary secretion. From my own observation I am confident that careful work will show diminution in the solids of high caloric value during the hottest weather.

A fact which admits of no discussion is this, that dietetic changes to meet the varying thermic conditions of climate and season are essential to normal metabolism in older children. Under what age this physiologic law is inoperative the most exacting artificial percentage feeders have neglected to state. Beginning with as low solids in their synthetic imitation of mother's milk as will sustain life, the rule is to increase gradually all the solids until an approximation of breast milk percentage is attained—the advancing age of the infant requiring a daily increase in the total quantity ingested. Whether from May to September or from October to January, whether in Florida or in Manitoba, the artificial emulsion must be pushed with increasing age. The sweltering infant's cry of thirst is inexorably met

with the bottled emulsion of higher proteids and hydrocarbons until the overtaxed digestion suddenly fails. Fermentation and putrefaction follow with acute intoxication and much speculation as to the etiologic rôle played by the organism of Shiga.

Under such dietary regimen of unnatural foods, unnaturally administered, we cease to wonder at the high death rate of bottle-fed babies in hot weather.

When a tithe of the work that has been expended to cheat the babe and mother out of their mutual rights by the substitution of artificial methods of feeding, shall have been devoted to the problem of lactation, its physiology and its pathology, then will the morbidity and mortality of the suckling cease to be the opprobrium of the medical profession and the Shiga bacillus, with its pathogenic congeners, may be relegated to the background.

SUGGESTIONS FOR REDUCING THE PREVALENCE OF SUMMER DIARRHEA IN INFANTS.*

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Summer diarrhea is caused by the entrance into the system, usually through some food medium, of a virulent poison, which is the product of micro-organisms.

The symptoms in a given number of cases of summer diarrhea will vary enough to enable one to recognize, aside from degrees, several forms of the disorder.

The nature of the infection—whether it was poisonous products already formed outside the body or whether it was bacteria as such that entered the gastro-intestinal tract—has been offered in explanation of this variation in symptoms. But since, thus far, there has been no single form of bacteria separated as being specifically responsible, it is possible that the nature of the organism itself has something to do with shaping symptoms.

However, what uncertainty exists as to the cause of the several forms of the disease does not make less absolute the conviction in the minds of bacteriologists that summer diarrhea is the result of bacterial infection and that whatever other factors are concerned are not causes *per se*, but are only conditions most favorable to the development of the bacteria and to the production of their poisons.

It was by accepting this view that Kerley¹ was able to prove so brilliantly the curable nature of the disease.

But summer diarrhea is better than curable—it is preventable. If a child is fed on a food containing neither poison nor organisms capable of producing poison that child will not be poisoned!

We witness, however, an annual recurrence of this disorder and in such prevalence as to show that we have thus far accomplished but little in the way of prevention. This unsatisfactory result is easily accountable.

First, because there is a large percentage of practitioners still believing that heat and humidity alone and without the presence of a single bacterium are capable of producing the disease.² This view precludes any acceptance of its preventable nature. Consequently, a large

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1. Kerley: "Treatment of Summer Diarrhea in Infants." New York Medical News, Aug. 4, 1900.

2. Editorial: "Summer Diarrheas in Children." THE JOURNAL A. M. A., July 4, 1902.