

## WHIRLING AS A CLINICAL TEST IN CHILDHOOD SCHIZOPHRENIA

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THE "whirling" response or test has been described as highly specific for childhood schizophrenia.<sup>1</sup> The test is performed as follows:<sup>1, 2</sup> The child stands with his arms extended, parallel to each other, and with his eyes closed (Fig. 1, A). In order that he may be distracted, he is asked to count. The head is now passively rotated to one side as far as possible without discomfort. Reaction is noted and the head is rotated to the other side. The positive response, or whirling, consists of the child's turning his entire body as long as the examiner turns his head (Fig. 1, B). The negative response consists of a slight rotation of the trunk but the entire body does not turn (Fig. 1, C).

Although the validity and reliability of the whirling test have never been demonstrated, the test is presented in the literature<sup>1-10</sup> not only as a diagnostic aid but as a characteristic sign of childhood schizophrenia. Furthermore, the test has been offered as important evidence for the "maturational lag" concept of childhood schizophrenia.<sup>6, 8, 11</sup>

The purpose of this investigation was to ascertain the value of the whirling test as a diagnostic aid and as confirmatory evidence for the maturational lag concept of childhood schizophrenia. This will be done by (1) reviewing the proposed clinical significance and physiological basis of whirling and its use as evidence for the

maturational lag concept of childhood schizophrenia and (2) comparing the incidence of whirling in a group of normal children with the incidence in a group of children with the diagnosis of schizophrenia.

### WHIRLING

*Clinical Significance.*—Bender<sup>1</sup> and Silver<sup>2</sup> stated that the whirling response is normal up to the age of 6 and that its persistence beyond that age indicates an abnormal condition. Teicher,<sup>12</sup> studying children with behavioral problems, indicated that the response is normal up to the age of 8 years.

Bender<sup>1</sup> regarded the test as highly specific for childhood schizophrenia after the age of 6. She<sup>1</sup> added, however, that it is a very sensitive test procedure for many types of motor disabilities in children. Silver<sup>2, 4</sup> stated that whirling after the age of 6 is seen in childhood schizophrenia, cerebral damage, and reading disabilities. Teicher<sup>12</sup> regarded its persistence after the age of 8 as a pathological response indicating general retardation or organic brain damage.

*Physiological Basis.*—Both the tonic neck reflex and the neck-righting reflex\* have been said to constitute the physiological basis of the whirling phenomenon.

\*Both the specificity and the classical reflex character of many of the Magnus "reflexes" have been questioned by Kurt Goldstein.<sup>13</sup>

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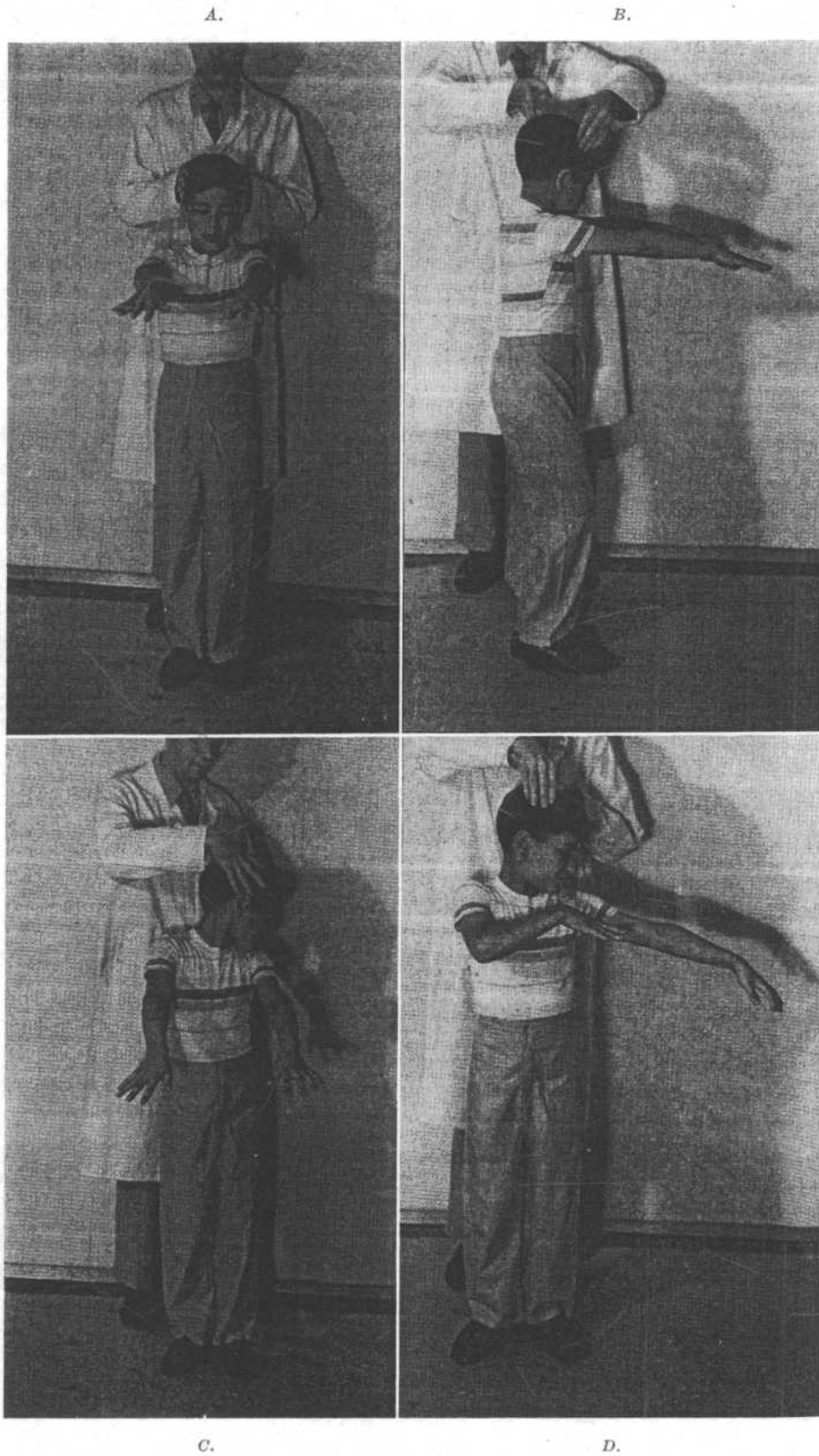


Fig. 1.—“Whirling” test. *A*, Starting position. *B*, Positive response or whirling.” *C*, Negative response. *D*, Classical tonic neck position.

Although not specifically stated, it is implied that the classical tonic neck reflex (Fig. 1 D) is commonly seen in schizophrenic children during the whirling test<sup>2, 14</sup> and this belief has apparently been used as evidence for the concept that the physiological basis of the whirling test is the tonic neck reflex.<sup>5, 6, 8, 10, 15</sup> Bender has stated repeatedly<sup>5, 6, 10, 15</sup> that the whirling response is based on, or is, a primitive tonic neck postural reflex.

The neck-righting reflex was described in animals by Magnus<sup>16</sup> as one of the many postural reflexes which permit an animal to assume and maintain an upright posture. The reflex orients the body in relation to the head. If the head of an animal is turned to the side the body will rotate to bring it to symmetrical alignment with the head. Schaltenbrand,<sup>17</sup> in 1925, was the first to attempt to elicit the neck-righting reflex in human infants and assumed that the response was the same as that described in animals by Magnus. Schaltenbrand stated further that the response normally disappears at about 5 years of age. (Schaltenbrand's work is discussed more fully elsewhere.<sup>18</sup>)

Because of the gross similarity between Schaltenbrand's neck-righting reflex in infants and the whirling phenomenon, both Schilder<sup>19</sup> and Silver<sup>2</sup> assumed that the neck-righting reflex is the basis of the whirling phenomenon.

*Whirling as Evidence for the maturational Lag Concept of Schizophrenia.*—In 1952 Bender<sup>6</sup> presented her concept of childhood schizophrenia as a "developmental lag at the embryological level, characterized by embryonic plasticity of the biological processes. . . . The biological areas are best defined according to Gesell's

concepts describing *The Embryology of Behavior*, namely, homeostatic mechanisms, tonic-neck reflex motor patterning, muscular tone, respiratory patterns, and waking and sleeping with changing states of consciousness."

This theory postulates that childhood schizophrenia is the result of the failure of certain "biological processes" to mature. The schizophrenic child, in the areas mentioned above, is at a stage of development characteristic of the normal fetus. The psychological characteristics of schizophrenia are secondary to this lag in development. The persistence of the whirling response above the age of 6 is a manifestation of immaturity in one of these biological areas: tonic neck reflex motor patterning.

According to Bender there are manifestations of immaturity in the other biological areas outlined by Gesell: soft "doughy" musculature, poor homeostatic control, abnormal speech-respiratory patterns, etc. But whirling is the most accessible to investigation and its presence in a child is readily determined, whereas the presence of many of the other signs of immaturity are difficult to evaluate objectively. Moreover, Bender<sup>6</sup> regarded whirling as one of the most important confirmations of her theory.

#### WHIRLING IN FOUR GROUPS OF CHILDREN

*Subjects and Methods.*—The first group consisted of 266 white children from middle-income families. They were from 6 to 11 years old and attended two public schools in Roselle, New Jersey. The second group consisted of 244 Negro children from lower-income families. They were from 5 to 11 years old and attended a large public school in the Harlem section of New York City. All of the

children in the middle-income white population were tested; the regular classes in the lower-income Negro population were randomly sampled.

The third and fourth groups tested were 44 children at Bellevue Hospital and 71 children at Rockland State Hospital, all of whom had had diagnoses of childhood schizophrenia. Bellevue, in attempting to detect less obvious cases of childhood schizophrenia, employs somewhat different diagnostic criteria, and, partly for this reason, its children appeared less disturbed than those at Rockland, many of whom were autistic, and the great majority of whom were obviously psychotic. This is disclosed by the fact that of the 71 children at Rockland only 48 could comply with the test, whereas all of the Bellevue children were in sufficient contact to perform the test adequately. Almost all of the children at Bellevue and an indeterminate number at Rock-

land had been tested previously. The children were from 6 to 11 years old and were from varied backgrounds.

The children were examined separately and in such a way that no child could have any knowledge of the test beforehand or view any other child taking the test. The test was performed as described above (Fig. 1). Some of the children will continue to rotate or whirl when the head is no longer being turned. This variety of response was designated as "continual whirling" and, as it may be interpreted to represent a more extreme positive response than the usual whirling response, in which the child will stop moving when the head is no longer being turned, this phenomenon was noted when present. In the tabulation of the results, the positives will include both varieties of whirling. Observations were also made for the presence of the classical tonic neck reflex (Fig. 1, D).

TABLE I

AGE (YEARS)	NO. TESTED	POSITIVE		NO. TESTED	POSITIVE	
		NO.	%		NO.	%
<i>A. Whirling in Normal Children</i>						
<i>Middle-income Whites.—</i>			<i>Lower-income Negroes.—</i>			
5	-	-	-	32	28	88
6	26	13	50	35	29	83
7	61	31	51	33	24	73
8	41	18	44	36	23	64
9	52	25	48	37	24	65
10	46	15	33	30	13	43
11	40	4	10	41	14	34
<i>B. Whirling in Schizophrenic Children</i>						
<i>Bellevue.—</i>			<i>Rockland.—</i>			
6	-	-	-	3	3	100*
7	6	5	83	4	4	100
8	10	7	70	9	8	89
9	13	9	69	11	10	91
10	7	4	57	12	8	75
11	8	2	25	9	5	56
<i>C. Continual Whirling</i>						
	MIDDLE-INCOME WHITES	LOWER-INCOME NEGROES	BELLEVUE SCHIZOPHRENICS	ROCKLAND SCHIZOPHRENICS		
Number tested	266	244	44	48		
Number positive	8 (3%)	57 (23%)	15 (34%)	22 (46%)		

*Results.*—

*Whirling:* The results are shown in Table I and Fig. 2. The Rockland schizophrenics had the highest and the middle-income whites the lowest incidence of whirling at every age level tested. These two groups were each significantly different from the two other groups tested and from each other.\* Between these two extremes

two normal groups is not a simple function of race and may be explained in part, at least, by the influence of environmental factors: the incidence of whirling in 53 7-year-old and 49 11-year-old Negro children who were in a higher socioeconomic group than the lower-income Negro children was 51 per cent and 55 per cent, respectively. This is significantly different

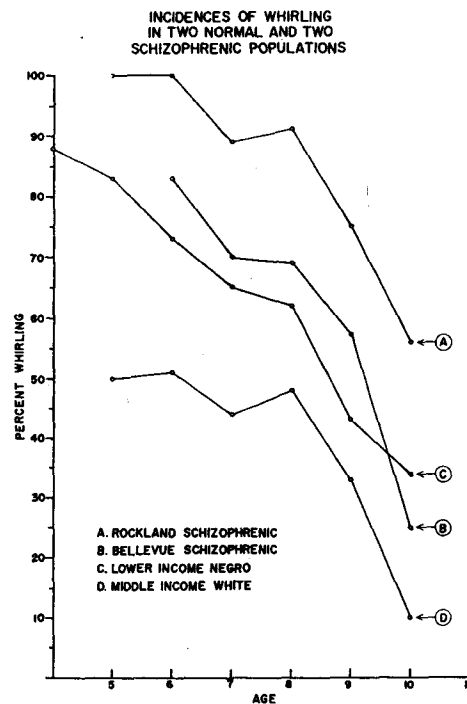


Fig. 2.

were the Bellevue schizophrenics and the lower-income Negroes. Although the Bellevue schizophrenics were slightly higher than the lower-income Negroes in the sample of the size tested, the difference is not significant.

There is evidence to suggest that the different incidence of whirling in these

\*The level of significance used throughout this paper is 5 per cent. The method used in comparing the incidence of whirling in the groups as a whole is the sign test because of the small size of the sample in each age group. All other comparisons are made using chi square.

from the incidence in the corresponding ages in the lower-income Negro population.

There was no significant difference between the incidences of whirling in boys and girls within any of the groups tested.

*Continual whirling:* Continual whirling was reported in terms of the whole group tested because there was no age trend. The incidence of continual whirling was significantly higher

in the lower-income Negroes than in the middle-income whites. The incidence of continual whirling was highest in the two schizophrenic groups but no significance can be attributed to the incidence of continual whirling in these groups because many of the children had been tested previously. (A study of the effect of repeated testing in 47 children disclosed that a child who does not whirl initially will not generally whirl on repeated testing and the converse. However, almost one third of the children who whirl initially will on being tested once or twice more whirl with greater ease and will whirl continually. Continual whirling, therefore, is only a reliable index of the ease of whirling when the child has never been tested previously.

*Tonic neck reflex:* None of the children in any group showed an unambiguous tonic neck reflex posture. Of the 92 schizophrenic children, 4 showed a posture which slightly resembled a tonic neck reflex; such postures were also seen in the normal groups during performance of the whirling test.

#### RELATION OF WHIRLING TO NECK-RIGHTING OR TONIC NECK REFLEX

The purpose of this study was to determine whether the same response, i.e., rotation of the body, as seen when the head is turned, could be induced by a completely different stimulus which has nothing to do with head rotation or position.

One crucial modification of the whirling test was made. The child was given identical instructions and began, as in whirling, with his arms outstretched, his eyes closed, and counting aloud. Then instead of turn-

ing the head, the examiner grasped the last digit of the middle finger of one hand and drew the arm laterally in an arc to the left side if the left arm was used, or to the right side if the right arm was used. As in the whirling study the child was observed for body rotation.

In this test we were interested in two questions: whether the incidence of whirling—that is, body rotation induced by head turning—would be similar to the incidence of body rotation induced by arm abduction; and also, whether a given child would respond in a similar way to both stimuli.

These tests were done on a group of Negro children from middle-income families.

The first question, whether the incidence of body rotation induced by head turning would be similar to that of body rotation induced by arm abduction was studied in two sixth-grade classes which together had a total of 49 students. Most of the children were 11-year-olds. On a random basis, half of the children, 25, were tested by head turning, and half, 24, by arm abduction.

The second question, whether a given child would respond in a similar way to both stimuli, was tested in two second-grade classes which together had a total of 53 students. Most of the children were 7-year-olds. Each child was tested by both head rotation and arm abduction. Half of the children, 27, were randomly picked to begin with head rotation followed by arm abduction; the other half, 26, with arm abduction followed by head rotation.

*Results.*—The results may be seen in Table II. The incidence of body rotation induced by head turning was

TABLE II. BODY ROTATION INDUCED BY HEAD TURNING AND ARM ABDUCTION

## A. 49 Sixth-grade Children, Either Arm Abducted or Head Rotated in Each Child

RESPONSE	HEAD ROTATION	ARM ABDUCTION
Positive	14 (56%)	14 (58%)
Negative	11	10
Total tested	25	24

## B. 53 Second-grade Children, Arm Abducted and Head Rotated in Each Child

RESPONSE		
Negative to both procedures		23
Positive to both procedures		27
Total either positive or negative to both		50 (94%)
No. responding differently to arm and head		8 (6%)
Total tested		53

practically identical with the incidence of body rotation induced by arm abduction. Furthermore, a given child generally responded to both procedures in an identical manner.

Thus the response of body rotation can be induced by a stimulus which has nothing to do with that used in eliciting neck-righting or tonic neck reflexes. The response of whirling, therefore, may have nothing to do with these reflexes, which are generally considered to be specific postural responses determined by head position.

## DISCUSSION

Several characteristics of the whirling response make it difficult to conceive of it as a reflex in the classical sense; the whirling response shows great variability between individuals, the stimulus is nonspecific, the latent period is long, there is voluntary control over the response, and repeated testing commonly alters the response.

Whirling is a complicated phenomenon and one can only speculate as to

why one child whirls and another does not. Some of these factors may be:

1. General patterns of compliance; a more compliant child may permit his body to be rotated. It was our impression from observing the behavior of the children in the normal groups that this may be one of the most important factors and may partly explain the difference between the Negro children from low-income families and the white children from middle-income families.

2. The child's conscious conception of what he is expected to do; this may depend upon his having seen the test performed on another child or having heard about the test. It may be a kind of projective test in which the child transfers his own attitudes toward authority into the test situation.

3. General postural patterns; a child with a more malleable or adaptable posture may whirl more readily than one with a stiff or rigid posture.

4. Enjoyment of rotational movement; a child who enjoys the sensation of rotating his body may be more likely to whirl.

5. A younger child is generally more likely to whirl. This is probably due to a change in the relative strength of some of the foregoing factors which comes with increasing age.

Several conclusions can be made concerning the whirling response:

1. It is affected by many factors.
2. The same response can be induced by stimuli not connected with neck or head position.
3. It is probably not based on the tonic neck or neck-righting reflex and probably is not itself a reflex.
4. The response, when present, frequently is more easily induced with repeated testing.

5. It is commonly seen in normal children between the ages of 6 and 11, and with decreasing frequency as the age increases.

6. It is commonly although not universally seen in schizophrenic children between the ages of 6 and 11. It is not accompanied by the classical tonic neck reflex.

7. The incidence of whirling appears to be significantly higher in a group of obviously psychotic schizophrenic children (at Rockland State Hospital) than in any normal group of children. In a group of children with the diagnoses of schizophrenia (at Bellevue Hospital), in whom an attempt was made to detect less obvious cases of abnormality, the incidence is slightly but not significantly higher than in a normal lower-income Negro group.

8. The whirling test cannot be employed as a diagnostic sign of mental disease because of the large number of children with mental disease who do not whirl.

9. The whirling response cannot be used as evidence in support of the maturational lag concept of childhood schizophrenia because normal children over 6 years of age commonly exhibit this phenomenon and because there is no evidence that whirling is based on primitive tonic neck reflex patterns.

In view of these considerations, it appears that with our present state of knowledge the whirling test is not a useful test in child psychiatry.

#### SUMMARY

"Whirling" is a postural test in which the head is turned and the body follows the rotation of the head. It has been claimed that a positive response in a child over the age of 6 indicates mental disease, particularly

childhood schizophrenia. In an attempt to evaluate this test, over 700 normal and schizophrenic children were tested. The incidence of whirling in both groups was found to be so high that the test could not be used in establishing a psychiatric diagnosis. The use of the test as evidence in support of the maturational lag theory of childhood schizophrenia is discussed.

#### REFERENCES

1. Bender, L.: Childhood Schizophrenia, *Am. J. Orthopsychiat.* 17: 40, 1947.
2. Silver, A. A.: Postural and Righting Responses in Children, *J. PEDIAT.* 41: 493, 1952.
3. Bakin, H.: Childhood Schizophrenia, *J. PEDIAT.* 37: 416, 1950.
4. Silver, A. A.: Diagnosis of the Various Syndromes Encountered in the Retarded Pre-adolescent Child, *Quart. Rev. Pediat.* 9: 127, 1954.
5. Bender, L.: The Schizophrenic Child, in Michal-Smith, H., editor: *Pediatric Problems in Clinical Practice*, New York, 1954, Grune & Stratton, chap. 4, pp. 51-70.
6. Bender, L.: Schizophrenia in Childhood—a Confirmation of the Diagnosis, *Trans. Am. Neurol. A.*, pp. 67-73, The William Byrd Press, Inc., Richmond, Va., 1952.
7. Pearson, G. H. J.: *Emotional Disorders of Children*, New York, 1949, W. W. Norton & Co., pp. 246-248.
8. Bender, L., and Helme, W. H.: A Quantitative Test of Theory and Diagnostic Indicators of Childhood Schizophrenia, *Arch. Neurol. & Psychiat.* 70: 413, 1953.
9. Freedman, A.: Maturation and Its Relation to the Dynamics of Childhood Schizophrenia, *Am. J. Orthopsychiat.* 24: 487, 1954.
10. Bender, L.: Schizophrenia in Childhood—Its Recognition, Description and Treatments, *Am. J. Orthopsychiat.* 26: 499, 1956.
11. Bender, L.: Nonpsychogenic Origins of Psychoses: Evidences From Studies of Childhood Schizophrenia, *Arch. Neurol. & Psychiat.* 70: 535, 1953.
12. Teicher, J. D.: Preliminary Survey of Motility in Children, *J. Nerv. & Ment. Dis.* 94: 277, 1941.
13. Goldstein, K.: *The Organism*, New York, 1939, American Book Co.
14. Bender, L., and Schilder, P.: Mannerisms as Organic Motility Syndrome, *Confina neurol.* 3: 21, 1941.
15. Bender, L., and Freedman, A.: A Study of the First Three Years in the Maturation of Schizophrenic Children, *Quart. J. Child Behavior* 4: 245, 1952.



16. Magnus, R.: Some Results of Studies in the Physiology of Posture; *Lancet* 2: 531, 1926.
17. Schaltenbrand, G.: Normale Bewegungs- und Lagereaktionen bei Kindern, *Deutsche Ztschr. Nervenhe.* 87: 23, 1925.
18. Spitzer, R., Kramer, Y., and Rabkin, R.: Neck Righting Reflex in Children, *J. PEDIAT.* 52: 149, 1958.
19. Schilder, P.: *Brain and Personality*, New York, 1931, Nervous and Mental Disease Publishing Co., pp. 92-106.
20. Hoff, H., and Schilder, P.: *Die Lagereflexe des Menschen*, Berlin, 1927, Julius Springer, pp. 32-33, 42-47, 153-155.
21. Schaltenbrand, G.: Development of Human Motility and Motor Disturbances, *Arch. Neurol. & Psychiat.* 20: 720, 1928.
22. Gesell, A.: The Tonic Neck Reflex in the Human Infant, *J. PEDIAT.* 13: 455, 1939.
23. Bender, L.: Childhood Schizophrenia, *Nerv. Child* 1: 138, 1942.
24. Bender, L.: Childhood Schizophrenia, *Psychiat. Quart.* 27: 663, 1953.

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*The Health of St. Louis in 1858*

The high water of the spring, followed by the extreme heat of the summer, have given rise to an unusual amount of intermittent and remittent disease during the present season, especially in the outskirts and environs of the city. During the hot weather of the latter part of July, and the beginning of August, quite a number of deaths occurred from sunstroke, principally among the intemperate and exposed; the same cause also gave rise to an increased mortality among young children during the same period.

Our hospitals, too, have been well filled with patients, and occasionally a death has taken place from yellow fever imported from New Orleans, but in no instance has this disease originated here, nor spread when introduced into a crowded ward—showing most conclusively its non-contagiousness.

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