

SANITARY CONDITIONS IN A RURAL AREA OF CATTARAUGUS COUNTY¹

I

A SANITARY SURVEY OF FARM HOMES

by DOROTHY G. WIEHL

RURAL sanitary conditions constitute a major health problem and, for farm populations, a peculiarly difficult one, depending, as it does, on the individual farmer. First, the farmer must be educated as to the need for and the methods of safeguarding his water supply and otherwise providing a sanitary environment for his family. Then there is the cost of making improvements, which though it need not be large, is an important consideration to the average farmer. The importance of the problem to the health of rural populations and the unsatisfactory state of farm sanitation have been recognized by rural sanitarians and public health administrators, and though progress has been slow, much has been accomplished in recent years, as, for example, in the control of hookworm in many southern states. In the North, diseases directly attributable to sanitary conditions are less prevalent but, nevertheless, there is need for improvement in the sanitary environment of the average farm family. This was pointed out by Winslow² in his study of Cattaraugus County, New York. Winslow found the water supplies of many of the small villages and private farm supplies of "exceedingly dubious quality." "There is no reason,

¹From the Division of Research, Milbank Memorial Fund and the Cattaraugus (New York) County Department of Health. The field data were collected by Clinton N. Woolsey with the cooperation of the Cattaraugus County Department of Health, and the water analyses were made in the County Department of Health Laboratory.

²Winslow, C.-E. A., Dr. P.H.: *Health on the Farm and in the Village*. New York, The Macmillan Company, 1931, Chapter IX.

however, to believe that conditions are different from those which obtain in most other counties," he writes. "They should be materially better when the excellent work of the County Engineer³ has had the time to exert full effect."

Naturally the Health Department of Cattaraugus County has directed its attention largely to community sanitation, but it is not unaware of the needs of the individual farmer. An opportunity to study farm conditions was afforded by a sanitary survey of farms in five rural townships which was made during the summer of 1930, in connection with special studies of morbidity and of the epidemiology of certain diseases which have been carried on in a rural section of Cattaraugus County since September, 1929, by the United States Public Health Service in cooperation with the Milbank Memorial Fund and the County Health Department. Data from this survey relating to farm sanitation are summarized in this report⁴ which is based only on families that were also in the morbidity study. The results give an indication of the nature and extent of the sanitary problem in a rural area which is believed to be typical of most rural counties in New York and probably in the northeastern part of the United States.

The farmers were classified into five broad economic classes by the field investigators for the special morbidity studies as follows: "comfortable," "upper moderate," "low moderate," "poor," and "very poor." The rating is chiefly an impression of the economic status of the family and the classifications

³A full-time sanitary engineer was appointed by the County Department of Health in 1929, one year before appraisal of conditions in the County was made by Professor Winslow.

⁴Two other reports based on this survey were: A Note on the Extent of Tuberculin Testing and Tuberculosis Infection in Cows in a Rural Area of Cattaraugus County. *Milbank Memorial Fund Quarterly Bulletin*, April, 1931, ix, pp. 46-51. Incidence of Contagious Abortion Among Cows in Cattaraugus County. *Ibid*, pp. 52-53.

are relative within the area rather than being related to any broader population group. Thus a family classed as comfortable here might in other more prosperous districts be considered of only moderate income, but the classes undoubtedly represent real differences in the economic status of the families in the study. These ratings make it possible to consider the sanitary environment and equipment in relation to the economic status of the farmer.

The general cleanliness of the farm premises was rated by the sanitary investigator according to a five-class scale using "A" for the highest grade and "E" for the lowest. Only 15 per cent of the farm homes, as shown in Table 1, were rated "D" or "E," which might be interpreted as noticeably

Table 1. Cleanliness of farm premises according to economic status of the family.

ECONOMIC STATUS	CLEANLINESS RATING ¹					
	Total	A	B	C	D	E
NUMBER OF FARM HOUSES						
<i>All income groups</i>	565	183	174	124	65	19
Comfortable	103	66	30	7	0	0
Upper moderate	225	95	80	36	11	3
Lower moderate	133	18	49	44	19	3
Poor and very poor	104	4	15	37	35 ²	13
PER CENT OF FARM HOUSES						
<i>All income groups</i>	100.0	32.4	30.8	21.9	11.5	3.4
Comfortable	100.0	64.1	29.1	6.8	0.0	0.0
Upper moderate	100.0	42.2	35.6	16.0	4.9	1.3
Lower moderate	100.0	13.5	36.8	33.1	14.3	2.3
Poor and very poor	100.0	3.8	14.4	35.6	33.7	12.5

¹The investigators arbitrarily rated the houses using "A" for the cleanest and "E" for the most dirty and untidy.

²Of these, one is "D" or "E."

untidly and dirty, while 32 per cent were rated "A." Cleanliness shows a marked association with the economic rating, as is evident in Table 1, and none of the farms of the highest economic class were rated "D" or "E," but 46 per cent of the farms of the "poor" and "very poor" were so rated.

The houses on about two-thirds of the farms were completely screened and another fourth were partially screened. (Table 2) Of the families classed as "comfortable," 93 per cent had homes that were completely screened, but less than 20 per cent of the poor families had completely screened their homes. Evidently the screens were not always used, since all the homes with complete screening were not reported as having "few" flies, and homes with "abundant" flies were more numerous than the homes without screens.

Table 2. Screening of farm homes and flies noted in the home at time of visit, July to September, 1930.

ECONOMIC STATUS	SCREENING				FLIES			
	All Homes	None	Partial	Complete	All Homes	Abundant	Moderate	Few
NUMBER OF HOMES								
<i>All income groups</i>	554	48	146	360	554	109	126	319
Comfortable	100	0	7	93	102	0	14	88
Upper moderate	223	4	46	173	222	19	48	155
Lower moderate	129	12	42	75	128	31	38	59
Poor and very poor	102	32	51	19	102	59	26	17
PER CENT OF HOMES								
<i>All income groups</i>	100.1	8.7	26.4	65.0	100.0	19.7	22.7	57.6
Comfortable	100.0	0.0	7.0	93.0	100.0	0.0	13.7	86.3
Upper moderate	100.0	1.8	20.6	77.6	100.0	8.6	21.6	69.8
Lower moderate	100.0	9.3	32.6	58.1	100.0	24.2	29.7	46.1
Poor and very poor	100.0	31.4	50.0	18.6	100.0	57.8	25.5	16.7

ECONOMIC STATUS	SOURCE OF WATER				PERCENTAGE FROM SPECIFIED SOURCE			
	All Sources	Public Supply	Spring	Well	All Sources	Public Supply	Spring	Well
All income groups	590	5	279	306	100.0	0.8	47.3	51.9
Comfortable	107	2	48	57	100.1	1.9	44.9	53.3
Upper moderate	231	3	108	120	100.0	1.3	46.8	51.9
Lower moderate	241	0	72	69	100.0	0.0	51.1	48.9
Poor and very poor	111	0	51	60	100.0	0.0	45.9	54.1

Table 3. Sources of water for farm families in Cattaraugus County, New York, according to economic status of the family.

In slightly more than half of the homes there were only a few flies.

The water supply for household use in this area comes about equally from springs and from wells. Of the 590 farmers reporting on the source of water, 279, or 47 per cent, used spring water, 306, or 52 per cent used well water, and 5 farms were supplied from a village water system. The source of the water supply for families in different economic classes is shown in Table 3. The use of wells or springs apparently is determined by chance and shows no variation according to the economic status of the family.

The wells are classified as to whether dug, driven, or drilled in Table 4. The type of well evidently did not vary according to the economic rating of the family, although a special analysis of water samples from about one-third of the wells showed that the dug well is less satisfactory than either driven or drilled wells. The results of the water analyses are discussed on page 146.

Spring water was in most cases piped to the house. This convenience, as we might expect, varied with the economic status, and all but 2 per cent of families in the highest eco-

ECONOMIC STATUS	NUMBER OF WELLS				PERCENTAGE OF SPECIFIED TYPE			
	All Types ¹	Drilled	Dug	Driven	All Types	Drilled	Dug	Driven
<i>All classes</i>	297	119	95	83	100.0	40.1	32.0	27.0
Comfortable	56	18	21	17	100.0	32.1	37.5	30.4
Upper moderate	117	50	29	38	100.0	42.7	24.8	32.5
Lower moderate	66	30	23	13	100.0	45.5	34.8	19.7
Poor and very poor	58	21	22	15	100.0	36.2	37.9	25.9

¹Type of well not specified in nine cases.

Table 4. Type of well used by farm families in different economic classes, in a rural section of Cattaraugus County, New York.

conomic class had piped the water to the house, but only 73 per cent of the poor families had done so. (Table 5.) More important from the sanitary aspect is the protection of the springs against pollution. Nearly 60 per cent of the farmers (Table 6) had enclosed the spring in a wooden or cement basin, and covered it or built a spring house around it; another 30 per cent had some form of protection, though less complete, and 10 per cent had made no effort to shield the spring from outside pollution. Carelessness in protecting the spring was definitely more frequent among the poor farmers.

Table 5. Percentage of farm families in a rural section of Cattaraugus County, New York, that piped the spring water according to economic status of the family.

ECONOMIC STATUS	TOTAL USING	WATER PIPED TO HOUSE	
	Spring	Number	Per Cent
<i>All income groups</i>	262 ¹	223	87.4
Comfortable	44	43	97.7
Upper moderate	103	90	87.4
Lower moderate	67	55	82.1
Poor and very poor	48	35	72.9

¹Not stated whether water was piped to house for seventeen families.

Twenty per cent of these farm houses had an inside running

water toilet, about 3 per cent had chemical toilets, and the remaining 77 per cent of farm families had only an outdoor privy. (Table 7.) Homes equipped with indoor water closets were found much more frequently among the group of farmers in the upper economic class. The percentage of homes with flush toilets was 42 for farmers classed as "comfortable" and the percentage steadily diminished with economic status to 5.5 per cent for farmers classed as "poor" or "very poor."

The effluent from about two-thirds of the flush toilets drained into cesspools, from one-fifth into septic tanks, and from the remaining one-tenth of the toilets drainage was into a nearby creek. From a sanitary standpoint, sewage disposal into the creek may not be very satisfactory depending upon the amount of running water in the creek and its proximity to the house. In at least one case the creek was dry at the time of the survey and an unsanitary condition existed.

The privies varied in type but half of them were the old-fashioned surface privy, 30 per cent were box privies, 9 per cent were the leaching vault type, and 5 per cent were the concrete vault type, as shown in Table 8. The surface privy was the most common type even on the farms of families classed as of "comfortable" or "upper moderate" economic

Table 6. Percentage of farm families in a rural section of Cattaraugus County, New York, that protected their springs against pollution, according to economic status.

ECONOMIC STATUS	TOTAL	BOTH COVERED AND BOXED OR IN SPRING HOUSE	COVERED OR BOXED	SOME OTHER PROTECTION	NO PROTECTION	PER CENT WITH SPECIFIED TYPE OF PROTECTION			
						Both Covered and Boxed	Covered or Boxed	Other Protection	No Protection
<i>All income groups</i>	225	150	40	39	26	58.6	15.6	15.2	10.2
Comfortable	46	33	6	6	1	71.7	23.9	1.3	1.3
Upper moderate	101	59	16	18	8	58.4	15.9	17.8	7.9
Lower moderate	63	36	11	8	8	57.1	17.4	12.7	12.7
Poor and very poor	45	22	7	7	9	48.9	15.5	15.6	20.0

ECONOMIC STATUS	NUMBER OF HOMES				PER CENT OF HOMES			
	Total Homes	Water Closet	Privy	Chemical Toilet	Total Homes	Water Closet	Privy	Chemical Toilet
<i>All income groups</i>	589	118	456	15	99.9	20.0	77.4	2.5
Comfortable	108	45	61	2	100.1	41.7	56.5	1.9
Upper moderate	232	53	176	3	100.0	22.8	75.9	1.3
Lower moderate	139	14	117	8	100.1	10.1	84.2	5.8
Poor and very poor	110	6	102	2	100.0	5.5	92.7	1.8

Table 7. Type of sewage disposal in a rural section of Cattaraugus County, New York, according to economic status of the family.

status, but the box privy and leaching vault type were found more frequently on these farms than on those of families of "poor" economic status.

The care exercised in keeping the privy in sanitary condition is equally as important, if not more important, than the type of privy. Only in a few cases was it stated that the privy was cleaned more often than every three months, except for chemical toilets which were nearly always cleaned frequently, at least monthly. Two or three cleanings a year was the usual report for surface privies, and box privies were cleaned somewhat more frequently. The farmers of low economic status were definitely more careless about the sanitary condition of the privy, nearly half reported that they cleaned the surface privy yearly, one-tenth that they "seldom" cleaned it, and another tenth "never."

In the majority of cases, the investigator noted whether or not the privy was flyproof and also whether the condition was "satisfactory," "full," or "overflowing." Slightly less than half of the privies were flyproof but over 60 per cent of those seen by the investigator were recorded as in satis-

factory condition. The percentages vary greatly according to the economic rating and of the privies owned by the "comfortable" 67 per cent were flyproof and 89 per cent in satisfactory condition, but of those owned by the "poor" families only 28 per cent were flyproof and 32 per cent in satisfactory sanitary condition.

The location of the privy in relation to the well was in nearly every case fairly satisfactory. On only one farm did the investigator report that the ground sloped steeply from the privy to the well. In five cases there was a moderate slope from the privy toward the well. About 12 per cent of the privies were 25 feet or less distant from the wells and 35 per cent were more than 50 feet distant.

For adequate protection of the health of farm families, it is obvious that there is great need to interest the farmer and to educate him in the methods and importance of providing

Table 8. Type of privy used in a rural section of Cattaraugus County, New York, according to economic status of the family.

ECONOMIC STATUS	TOTAL HOMES	TYPE OF PRIVY				
		Surface	Box	Leaching Vault	Concrete Vault	Other
NUMBER OF HOMES						
<i>All income groups</i>	430	230	135	41	22	2
Comfortable	56	27	23	3	3	0
Upper moderate	164	81	48	25	8	2
Lower moderate	114	58	44	6	6	0
Poor and very poor	96	64	20	7	5	0
PER CENT OF HOMES						
<i>All income groups</i>	100.0	53.5	31.4	9.5	5.1	.5
Comfortable	100.1	48.2	41.1	5.4	5.4	0.0
Upper moderate	100.0	49.4	29.3	15.2	4.9	1.2
Lower moderate	100.1	50.9	38.6	5.3	5.3	0.0
Poor and very poor	100.0	66.7	20.8	7.3	5.2	0.0

sanitary surroundings. While unsanitary conditions on the farm are a menace chiefly to the health of the individual family and the opportunity for serious infections to occur or to be spread is much less than where groups of families live together in villages and towns, the right of the farm family to hygienic home surroundings and the responsibility of health authorities to aid in providing such an environment is recognized. Ignorance of the farmer concerning sanitary matters and indifference which is frequently based on ignorance are basic to the problem, but it is apparent that the farmer's economic status is a weighty contributing factor.

II

ANALYSES OF WATER SUPPLIES OF 212 FARMS

by EDMUND K. KLINE, DR. P.H.⁵

SAMPLES of water from 214 different farm supplies included in the sanitary survey upon which Miss Wiehl has reported, were submitted to the County Department of Health laboratory. Two samples were not marked as to the type of well from which they were taken and are omitted from the tabulations.

Table 9. Quality of water samples from various sources on farms in rural Cattaraugus County, New York.

SOURCE OF WATER	NUMBER OF SPECIFIED QUALITY					PERCENTAGE OF SPECIFIED QUALITY				
	Total	Good	Fair	Poor	Bad	Total	Good	Fair	Poor	Bad
<i>All sources</i>	212	90	31	38	53	100	42	15	18	25
Springs	124	44	25	24	31	100	36	20	19	25
Wells	82	42	6	13	21	100	51	7	16	26
Drilled	44	24	5	9	6	100	55	11	20	14
Dug	21	8	0	3	10	100	38	0	15	47
Driven	17	10	1	1	5	100	59	6	6	29
Public supplies	6	4	0	1	1					

⁵Director of Laboratories, Cattaraugus County Department of Health.

SOURCE OF WATER AND QUALITY ON B. COLI TEST	NUMBER OF SAMPLES GIVING SPECIFIED BACTERIA COUNT PER C.C.							PER- CENTAGE HAVING A COUNT LESS THAN 10
	Total Sam- ples	More than 1,000	500- 1,000	100- 500	50- 99	10- 49	0-9	
<i>Springs—all</i>	122 ¹	11	6	10	5	17	73	59.8
Good—Fair	67 ¹	3	2	3	1	10	48	71.7
Poor—Bad	55	8	4	7	4	7	25	45.5
<i>Wells—all</i>	80	8	1	9	2	14	46	57.5
Good—Fair	46	5	1	4	1	3	32	69.6
Poor—Bad	44	3	0	5	1	11	14	31.9
<i>Drilled or driven wells</i>	59	3	1	7	2	9	37	62.8
Good—Fair	38	3	1	4	1	2	27	71.2
Poor—Bad	21	0	0	3	1	7	10	47.7
<i>Dug wells</i>	21	5	0	2	0	5	9	42.8
Good—Fair	8	2	0	0	0	1	5	62.5
Poor—Bad	13	3	0	2	0	4	4	30.7

¹Count for two samples unknown.

Table 10. Bacteria count on water samples from various sources and of different quality taken from farm supplies in rural Cattaraugus County, New York.

An arbitrary classification was adopted for laboratory findings of “confirmed *B. coli*” on the following basis:

Good—No confirmed *B. coli*

Fair—1 or 2 positive 10 c.c. portions (of a total of 5)

Poor—3 to 5 positive 10 c.c. portions

Bad—Positive in all 10 c.c. portions (5) and in addition positive in 1 or more, 1 or 1/10 c.c. portions.

Only the classification “good” would be acceptable in most other work, but so far as we know there is no standard for rural water supplies and this grading would seem to be quite lenient enough to allow for a certain amount of deviation from stricter standards applicable to public supplies.

The results of this tabulation are found in Table 9 which also shows the percentage of each group of samples included

DEPTH OF WELL	NUMBER OF WELLS			PERCENTAGE OF WELLS		
	Total	B. COLI CLASS		Total	Good— Fair	Poor— Bad
		Good— Fair	Poor— Bad			
<i>Drilled wells</i>	39	28	11	100.0	71.8	28.2
75 ft. or more	21	16	5	100.0	76.2	23.8
25-74 ft.	18	12	6	100.0	66.7	33.3
<i>Driven wells</i>	11	7	4	100.0	63.7	36.3
25 ft. or more	5	4	1	100.0	80.0	20.0
Less than 25 ft.	6	3	3	100.0	50.0	50.0
<i>Dug wells</i>	13	6	7	100.0	46.2	53.8
25-49 ft.	7	3	4	100.0	42.9	57.1
Less than 25 ft.	6	3	3	100.0	50.0	50.0

Table 11. Depth of well according to type and quality of water on farms in Cattaraugus County, New York.

in each class. Taken as a whole 42 per cent of the samples were good, 15 per cent fair, 18 per cent poor, and 25 per cent bad. The best showing, excluding the few samples taken from public supplies, was made by driven wells with 59 per cent good and the poorest showing by dug wells with 47 per cent bad.

The total counts of the bacterial content of the water samples are presented in Table 10 according to the source of the water and also according to sanitary quality as

Table 12. Samples giving "presumptive *B. coli* tests" which failed to "confirm" as *B. coli* according to the survey in Ellicottville, New York, 1930.

Final Quality Classification	Good	Fair	Poor	Bad	Total
<i>Total Wells</i>	29	16	11	5	61
Drilled	3	1	3	0	7
Dug	5	0	1	2 ¹	8
Driven	2	0	0	0	2
<i>Springs</i>	19 ¹	15	7	3	44

¹Anaerobes were found in 2 good springs and 1 bad dug well. All of the other specimens gave typical "colon" colonies on Endo media but failed to produce gas from the colonies fished from these plates. All of them were gram negative bacilli.

These 61 specimens gave 144 cultures which were divided as follows: Anaerobes—2 ten c.c. tubes and 1 one-tenth c.c. tube. Nonfermenters—110 ten c.c. tubes, 25 one c.c. tubes, and 6 one-tenth c.c. tubes.

shown in Table 9. The fact should be noted that samples were not iced when brought to the laboratory. The bacterial content of waters from different sources did not vary significantly, except that fewer samples from dug wells had a bacterial content of less than 10 per c.c. than samples from any other source. The percentage of each kind of samples which showed a bacteria count of less than 10 per c.c. does show a correlation with the sanitary quality.

The quality of the water according to the depth of wells, where this information was given on the survey sheet, is compiled in Table 11. There seems to be no correlation between depth and quality, and the deepest well, 260 feet, was a poor one.

One of the most interesting results of the survey work is shown in Table 12, which lists the samples which gave presumptive tests for *B. coli* (fermentation in lactose broth in forty-eight hours) but which failed to show completed *B. coli* tests in all tubes giving the presumptive test. While sixty-one samples were shown to belong in this group, sometimes several tubes from one sample were concerned. The number of tubes involved is shown in the accompanying summary.

	<i>Tubes Inoculated</i>	<i>Tubes Fermenting</i>	<i>Tubes Confirming</i>	<i>Anaerobes</i>	<i>Non-fermenters</i>
10 c.c.	1,070	582	470	2	110
1 c.c.	428	119	94	0	25
1/10 c.c.	428	44	37	1	6
<i>Total</i>	<i>1,926</i>	<i>745</i>	<i>601</i>	<i>3</i>	<i>141</i>

The group marked nonfermenters gave gas in the original fermentation tube, grew on Endo media, usually with the sheen and coloration typical of colon colonies, but failed to ferment when single colonies were reinoculated into lactose broth. They were gram negative bacilli. As shown in the summary most of them came from springs.

These results are of great interest because such types of organisms have repeatedly demonstrated in experimental laboratory studies on the influence of salamanders on the quality of water supplies.⁶

⁶The results of special studies of pollution of spring water by salamanders were reported by Dr. Kline before the Laboratory Section of the American Public Health Association, Montreal, September, 1931. They may be summarized as follows:

Salamanders of the family Plethodontidae are frequently found in the rural spring water supplies of the Appalachian range of mountains. Field studies show that these animals live in large numbers deep in the underground streams supplying springs and that at certain seasons they wander from the water and feed in the surrounding land area. At this time they may become infected with colon bacilli. Laboratory experiments show that after becoming infected their gastro-intestinal tracts may act as incubators or reservoirs from which large numbers of *B. coli* are expelled over a considerable period of time. A continuation of this process after they have returned to the underground stream above the spring may influence the laboratory tests so as to suggest condemnation of an otherwise safe water supply. Methods for the protection of such supplies should be revised so as to eliminate such salamander pollution.

The full report, "Some Experimental Evidence Concerning the Interpretation of Laboratory Findings in Rural Water Supplies of the Appalachian Area" by Edmund K. Kline, Dr. P.H., and Nelson M. Fuller, will be published in a forthcoming issue of the *American Journal of Public Health*.