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SOME IMPROVEMENTS IN THE PERFORMANCE TEST FOR RATING DISHWASHING DETERGENTS [1]

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A washing performance test for studying detergents to be used in the cleansing of dishes and utensils in dairy and restaurant sanitization was presented in an earlier paper (*1*) from this laboratory. A detailed description of a standardized technique for performing the test was given and it was pointed out that changes in the washing machine, in the composition of the soil and in the techniques of the test would all affect the results obtained. Since the publication of the first paper, work has been continued on the application of the test to a number of detergents and additional factors have been found which affect the washing performance of a detergent tested by this procedure. It was found that the soiling technique formerly recommended did not guarantee reproducibility and the simple empirical method of calculation was not satisfactory for precise work. Improvements in the technique have been devised and because of the interest shown in the test they are being presented for the benefit of workers in the field.

METHOD OF CALCULATING THE RESULTS

The original method suggested for calculating the results of a washing performance test was based for simplicity on the assumption that the soil removed was directly proportional to the difference in the photometer readings that indicated light absorbed by the soil. This assumption, which is not strictly correct, provided a simple method of calculation that was believed sufficiently accurate for use in connection with the test. Actually the soil removed, according to Lambert's law, varies directly with the difference in the logarithms of the photometer readings. For solids Lambert's and Beer's laws state that the following relationship holds:

$$I = I_o \, 10^{-Kd}$$

or

$$Kd = \log \frac{I}{I_o}$$

[1] From the Sanitary Engineering Division.

where: I=the intensity of the light transmitted; I_o=the intensity of the incident light; K=a constant for the wavelength and compound and; d=the thickness of the soil.

This equation indicates that the thickness of the soil is proportioned to the logarithm of the intensity of the transmitted light over the intensity of the incident light.

Let R represent the percentage of soil removed by washing. Then:

$$R=\frac{\text{original soil on slides}-\text{soil remaining after washing}}{\text{original soil on slides}}\times 100 \quad (1)$$

To make the above calculation for this test, all that is required is to substitute the proper light absorption values for each term in the above equation. In the test the following light intensities are obtained directly by photometer readings:

I_o=incident light=the initial reading with no slides in the photometer.

I_s=transmitted light through soiled slides, i. e., meter reading with soiled slides in the photometer.

I_c=transmitted light through clean slides, i. e., meter reading with the original clean slides in the photometer.

I_w=transmitted light through washed slides, i. e., meter reading with washed slides in the photometer.

Since the thickness of the soil is proportional to the log $\frac{I}{I_o}$ we can define the terms in equation 1, above, directly in light values. The light absorbed by the original soil on the slides may be represented by, log $\frac{I_c}{I_o}-\log\frac{I_s}{I_o}$ and the light absorbed by the soil remaining after washing may be represented by, log $\frac{I_c}{I_o}-\log\frac{I_w}{I_o}$

Substituting these values in equation 1 we have—

$$R=\frac{\left(\log\frac{I_c}{I_o}-\log\frac{I_s}{I_o}\right)-\left(\log\frac{I_c}{I_o}-\log\frac{I_w}{I_o}\right)}{\log\frac{I_c}{I_o}-\log\frac{I_s}{I_o}}\times 100$$

Now it will be noticed that I_o appears in the denominator of every term. Consequently in this equation, if I_o is kept constant throughout an observation of clean, soiled and washed slides the above equation becomes:

$$R=\frac{(\log I_c-\log I_s)-(\log I_c-\log I_w)}{\log I_c-\log I_s}\times 100$$

$$=\frac{\log I_w-\log I_s}{\log I_c-\log I_s}\times 100 \quad (2)$$

To make a calculation of the percentage of soil removed in a washing performance test, it is necessary only to keep I_o constant, substitute the logarithms of the meter readings for the clean, soiled and washed slides in equation 2 and complete the computation.

The comparative results for soil removal obtained on a series of tests with trisodium phosphate solution calculated by the original simple empirical procedure and also by equation 2 are as follows:

Determination No.	Percentage of soil removed								Coefficient of variation percent	Standard deviation percent
	1	2	3	4	5	6	7	Mean		
Calculation by Meth. (1) [1]	25. 2	33. 3	33. 3	89. 0	88. 0	88. 5	91. 0	63. 3	45. 2	±28. 6
Calculation by Meth. (2) [2]	51. 2	60. 2	60. 2	93. 8	95. 8	96. 9	97. 3	79. 3	24. 5	±19. 4

[1] Simple empirical calculation.
[2] Equation 2 calculation.

In the above determinations and in all other tests presented, six slides were washed and examined simultaneously as recommended in the original procedure. These data indicate that the Lambert's law calculation procedure, equation 2, gives consistently higher and truer percentages of soil removal. The data also show that this method of calculation gives a lower standard deviation and coefficient of variation in a series of tests on the same detergent. Equation 2 has therefore been adopted for the calculation of the results of all tests made in this laboratory and is recommended for use with the test where the most precise results are desired for comparative purposes.

STUDY OF SOILING TECHNIQUE AND EFFECT OF THICKNESS OF SOIL ON THE REMOVAL EFFICIENCY

In the data on the efficiency of trisodium phosphate presented above, the results on the first three determinations were obtained on slides soiled and washed on one day and determinations 4 to 7 were obtained on slides soiled some days later and washed. It will be noticed that the results were very consistent on the determinations in which the slides were soiled at the same time and that a big difference occurred in the groups of determinations on slides soiled on different days. Such differences in efficiency with successive tests on the same detergent were considered too great. Consequently a careful search was made for the possible factors that contributed to the variability in the results of the performance test. Many theories were followed up to account for this variability without finding the cause of the principal difficulty. A comparison of photometer readings of the soiled slides and the subsequent percentage of soil removed indicated a

slight tendency for greater washing efficiencies with low I_s readings indicating heavily soiled slides. This suggested that soil density on the slide might be important and a study of this factor was undertaken.

The original technique of spreading the undiluted Hucker (*2*) soil on the slides with a rubber roll was not suitable for the accurate control of soil thickness. Consequently the soiling technique was modified by immersing the clean slides in a bath containing soil diluted to a definite viscosity, draining and thereafter baking as usual. To study this procedure, 8 sets of 6 slides held in Coplin staining racks were dipped into a 25 percent dilution of soil and allowed to drain horizontally for 1 to 15 minutes. The intensity of the light transmitted, I_s, by the slides treated by this procedure follows:

Slide set No	1	2	3	4	5	6	7	8
Draining time (minutes)	1	2	3	3	5	5	10	15
Intensity transmitted I_s	7.	9.	9.	10.	8.	10. 5	10.	10.

From this experiment a draining time of 5 to 10 minutes was selected before baking. Draining the slides in the vertical position was also adopted because in this position a smaller area of heavy bead was formed near the bottom edge.

A series of washing performance tests were made with 0.3 percent trisodium phosphate solution in Cincinnati tap water at 140° F. for 3 minutes on four series of slides on which the soil thickness was controlled by dipping the slides into soil dilutions of known viscosity. Unfortunately three different batches of Hucker soil had to be used in the successive experiments. The pertinent results obtained in these experiments and in one series in which the original rolling technique of soiling was used, are given in table 1.

TABLE 1.—*Results of washing performance tests on trisodium phosphate solution showing the effect of method of application and thickness of soil on the test*

Slide soiling technique	Batch of Hucker soil	Number of determinations	Viscosity of soil dilution* seconds	Soiled slides		Mean percent soil removed	Standard deviation percent	Coefficient of variation percent
				I_s	Coefficient of variation in I_s			
Rolling	A	7		3	87	79	19	25
Dipping	B	15	[1] 26. 2	6	23	86	5.1	5.9
Dipping	C1	9	[2] 26. 4	23	4	52	8. 4	16.2
Dipping	C2	6	[3] 28. 5	15	10	87	4. 8	5. 5
Dipping	C3	6	[4] 36. 3	5	24	99	.7	.7
Dipping	[6] C2	3	[5] 30. 9	8	7	93. 3	.6	.6

*The viscosities were determined with a 25 ml. pipette which delivered 25 ml. of distilled water in 23 seconds at 28° C.

Six slides used in each determination:
[1] at 28° C., [2] at 24° C., [3] at 21° C., [4] at 23° C., [5] at 24° C.
[6] Aged 3 months, same percentage dilution as C2.

The data in table 1 indicate that both the batch of soil and the viscosity of the dilution of soil used for soiling slides effects the percentage of soil removal obtained. As the viscosity of soil dilution was increased in the three series of tests in which the same batch of soil was used the I_s readings of 23, 15, and 5 indicated increased thickness of soil on the slides. As the soil thickness was increased in these series of tests the percentage of removal increased successively from 52 percent to 87 percent to 93 percent and 99 percent. The direct correlation between the thickness of soil on the slides and the percentage of soil removed by the detergent in this test is the most important factor shown by these data.

It will also be noticed in table 1 that the coefficient of variation of the transmitted light intensity I_s, of the soiled slides decreased as the mean value of I_s increased. In other words the uniformity of the soil on the slides varied inversely with the thickness of this soil. It is also apparent that the new soiling procedure reduced the standard deviation and coefficient of variation in the performance in all series of performance tests below that obtained in the series where the soil was applied by rolling.

EFFECT OF THICKNESS OF SOIL ON WASHING PERFORMANCE WITH VARIOUS DETERGENTS

To determine whether soil thickness was also an important factor in the performance of other detergents performance tests with slides having different thickness of soil were run with seven detergents. The results of these tests have been summarized in table 2.

TABLE 2.—*The effect of thickness of soil on the percentage of soil removed by various detergents*

		Mean percentage of soil removed				Standard deviation from mean				Coefficient of variation			
Mean I_s, indicating soil thickness [1]		5–9	10–14	15–19	20–25	5–9	10–14	15–19	20–25	5–9	10–14	15–19	20–25
Detergent	No. of Tests												
Tap water	26	-----	13	7	0	-----	8	6	-----	-----	68	86	-----
Borax	24	29	21	11	0	7	4	5	-----	25	20	50	-----
Sodium carbonate	74	72	59	54	32	10	9	11	11	14	15	21	34
Sodium meta silicate	16	73	70	-----	41	13	7	-----	4	18	11	-----	10
Trisodium phosphate	83	80	-----	69	64	11	-----	13	12	14	-----	19	19
Detergent A	12	93	-----	-----	76	1.7	-----	-----	3	2	-----	-----	4
Castile soap	12	97	94	-----	77	0.5	1.2	-----	9	0.5	1.3	-----	4
Detergent B	34	98	-----	94	83	2	-----	3	9	2	-----	-----	10
Average	-----	77	61	57	53	-----	-----	-----	-----	-----	-----	-----	-----

[1] The thickness of soil is inversely proportional to the logarithm of I_s (the transmitted light through the soiled slides).

These data show that with every detergent tested the percentage of soil removed depended somewhat on the soil density or thickness. It is true that the performance of the best performers in this group were

less affected by this factor than the others. The importance of the soil thickness factor in this test is best illustrated in the results with sodium carbonate which might be classified in a short series of tests either as a poor detergent or a good detergent depending upon the quantity of soil applied to the slides. With all detergents a larger percentage of soil removal is shown when high concentrations of soil are on the slides. Consequently high soil concentrations decrease the spread in the percentage performance of the poor to excellent detergents. The lower soil concentrations increase the performance spread from the poor to the best detergents.

On the basis of the data presented in tables 1 and 2 it becomes apparent that comparative results on detergents under study in different laboratories or even in the same laboratory can not be obtained by this test until not only the composition of soil but the soil thickness on the slides as indicated by the soiled slide reading, I_s, is very carefully standardized. To maintain a good spread in performance on poor to excellent detergents and at the same time minimize the deviations in a series of tests on the same detergent a medium soil thickness on the slides is recommended. This may be obtained by diluting the Hucker soil the necessary amount to produce slides with average I_s readings between 15 and 20 after they are dipped into the soil solution, drained for 5–10 minutes and baked as usual at 95° C. It is possible that continued study of this method of testing will indicate the desirability of tests at two soil thickness ranges.

SOME OBSERVATIONS ON THE TRANSMITTED LIGHT READINGS THROUGH SOILED AND WASHED SLIDES

A compilation of the transmitted light readings for the washed slides indicated that these readings were about constant for each detergent regardless of soil thickness at the start. These data are shown in table 3.

TABLE 3.—*Comparison of mean washed slide readings for corresponding soiled slide reading ranges for representative detergents*

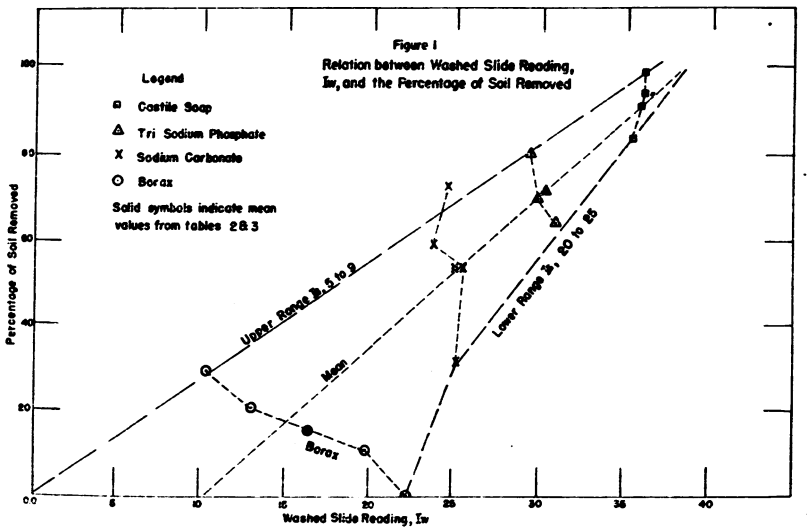
[Transmitted light, washed slides, I_w (mean)]

Transmitted light—Soiled slide I_s (range)	Detergents							
	Tap water	Borax	Sodium carbonate	Sodium meta silicate	Trisodium phosphate	Det. A	Castile soap	Det. B
5–9	------	11.1	24.6	24.1	29.3	34.3	37.5	37.5
10–14	16.9	16.7	23.7	27.3	------	------	37.5	------
15–19	18.1	19.8	26.2	------	30.7	------	------	37.5
20–25	22.6	23.0	25.8	28.3	32.3	33.6	35.0	36.0
Mean	19.2	17.7	25.1	26.6	30.8	34.0	36.7	37.1

In this study a total of 74 washing performance tests were made with sodium carbonate, using soil thicknesses represented by soiled

slide readings from 5 to 25. The mean washed slide reading for this entire series was 25.5 with a standard deviation of ±2.9 and a coefficient of variation of ±11.0 percent. A maximum washed slide reading of 32.5 and a minimum of 19.6 was observed in this series. The coefficient of correlation between the soiled and washed slide light readings on this series of tests was 0.27 demonstrating that there was little correlation between these parameters.

In table 3 the data on washed slides for tap water alone and for borax do not show any constancy as the soil thickness is varied. A relatively constant washed slide reading that is independent of the soiled slide reading is indicated for the other detergents in this table. From the data given it may be assumed that with detergents in the washing performance category of detergents better than sodium carbonate, the washed slide reading will be indicative of the performance of the detergent and will be independent of the thickness of soil on the slide. The washing performance of a detergent may therefore be estimated from the washed slide readings only, on the basis of the above assumption. A curve showing the relationship between the washed slide readings I_w and the percentage of soil removed prepared from tables 2 and 3 is shown in Figure 1.



IMPLICATIONS OF THE CONSTANT WASHED SLIDE READING, I_w

The observation that the washed slide readings I_w for a given detergent are more or less constant tends to support an electric charge theory of soil removal. According to van der Werth (*3*) soil particles have a positive charge and soap particles have a negative charge permitting union of the soil and the soap. Tyutyunnikov (*4*) suggests

that detergent capacity can best be expressed in terms of the energy required between the substrate and the soil. Boutaric and Perreau (*5*) studied the change in electrical charge on colloids and found that the charge may be reversed with the change in concentration of the electrolyte causing flocculation or dispersion. Briggs (*6*) postulates that every solid has a specific absorbing power for a given ion which depends upon a number of factors. These factors include the specific surface of the solid, the temperature, the concentration of the particular ion in the solution, and upon the other ions present or absorbed previously by the solid.

Glass is usually negatively charged when placed in water (*6*). If the soil is positively charged it will be attracted and held on the glass electrically. If a solution of detergent comes into contact with the soiled glass to remove the soil the attraction of the particles in the solution for the soil must be higher than the attraction of the glass for the soil. Or the particles formed by chemical action of the detergent on the soil must have a lower attractive force for the glass. In our test the concentration, temperature, and chemical action of the detergent solution and the mechanical action of the washing machine are all constant, and the amount of soil removed is dependent upon the breaking of the electrical union between the glass and soil. If the glass has a specific absorption power for a given ion, and the attraction of the glass for the soil particles is constant, the amount of soil adhering to the glass after treatment with any given detergent will be constant and independent of the original thickness of the soil. The soil changed chemically by the action of the detergent or the calcium or magnesium hardness salts precipitated from the water may be substituted for the original soil film and adhere to the glass slide depending upon the charge on the glass. Electrolytes in the detergent may reverse the charge of particles in the solution so that a film of greater density or thickness may be built upon the glass slide. This may explain why some calcium and magnesium compounds will form a heavier film than others depending upon the precipitant.

As indicated in table 3, borax does not produce a constant washed slide reading, I_w. The charge of the borax may approach that of the glass so that the removal shown may be strictly due to the mechanical work of the machine. It will be noticed in table 3, also, that the soil removal obtained when the slides are washed in tap water alone approaches that shown by borax.

Another series of experiments were made on eight sets of slides boiled in a detergent solution which are pertinent to this discussion. In these experiments one set of clean slides was used having an I_c reading of 42. Seven sets of slides were soiled and had I_s readings from 14.5 to 35.0. Each set of these slides was boiled for 5 minutes in a 0.3 percent solution of sodium carbonate containing also 0.1

percent of the Hucker soil. Each set was dried without rinsing before examination. The results given in table 4 show final I_w readings within a range of 21.5 and 28.5 with a mean of 24.7.

TABLE 4.—*Transmitted light readings, I_w, on a number of sets of slides boiled in sodium carbonate solution containing Hucker soil.*

Set No.	Original condition	Original light reading, I_c or I_s	Final light reading, I_w	Deviation from mean
1	Clean	42	25.5	+0.8
2	Soiled	24.5	26.0	+1.3
3	Soiled	28.5	28.5	+3.8
4	Soiled	26.0	25.0	+0.3
5	Soiled	32.5	24.5	−0.2
6	Soiled	35.0	22.5	−2.2
7	Soiled	16.0	21.5	−3.2
8	Soiled	14.5	24.0	−0.7
Mean			24.7	

It was found that the mean I_w readings on the series of washing performance tests with sodium carbonate was 25.5. This compares to the mean value of 24.7 found in this series of tests when slides with various initial readings were boiled with sodium carbonate containing some of the same soil. It will also be noted that if the set of slides were cleaner than indicated by an I_w reading of 24.7 a build up of soil occurred in all cases except one and if the slides had a lower reading than 24.7 initially a removal of soil was indicated and this mean was approached. The data of these experiments seem to support the proposed electrical attraction theory of soil removal and build-up.

The variations in the transmitted light readings for the washed slides, I_w, with a given detergent indicate and emphasize the importance of standardizing the soiled slide readings within a limited range if reproducible and constant washing performance results are to be obtained by different laboratories. For example with the soiled slide reading range maintained between 15 to 20, the percentage removal of soil by sodium carbonate, which gives a mean I_w of 25.5 ± 2.9 will vary considerably. With I_s at 15 and I_w at 25.5 ± 2.9 the removal performance would spread from 42 to 65 percent and with I_s at 20 and I_w at 25.5 ± 2.9 the performance would spread from 18 to 51 percent. Consequently values from 18 percent to 65 percent removal of soil are frequently obtained with sodium carbonate in Cincinnati tap water even when the soil thickness is held between I_s reading limits of 15 to 20. This variability in the performance test results with sodium carbonate may be associated with variations in the soil and in the chemical constituents of the Cincinnati water. Consequently sodium carbonate is not recommended as a reference detergent and the other chemical detergents shown in table 2 with less variability will serve better as reference detergents.

EFFECT OF VARIOUS BATCHES OF HUCKER SOIL ON THE TEST

The data in table 1 suggested that the washing performance obtained with trisodium phosphate was also affected by a variation in different batches of Hucker soil. A careful study of the effect of soil composition on performance obtained with a series of detergents when the soil density on the slides has been controlled is needed. Unfortunately we have not been able to undertake this study to the present. However, it appears that certain slight modifications in the preparation of the present Hucker soil will improve the uniformity of the batches. It is recommended that the soil be prepared by weighing the 0.5 gm. portion of printer's ink and linseed oil mixture in place of measuring this mixture volumetrically by drops. A difference in drop size of the ink and linseed oil will give different degrees of grayness to the soil film. Since it is necessary to control the thickness of the film on the slides by the I_s reading it is also necessary that the above important elements of light absorption of the soil be carefully controlled in making up each batch.

OTHER FACTORS AFFECTING THE TEST PROCEDURE

It was observed that after continued use the light bulb in the photometer becomes darker and transmits less light. The darkening of the bulb caused a gradual lowering of the transmittancy reading, I_c, when the technique originally recommended was followed. To avoid this the present technique is to adjust the variable resistances on the photometer until a reading of 40 is obtained with the clean slides. In other words I_c is always 40, and I_o, the initial or reference reading is recorded after the clean slides are removed.

Originally it was suggested that the detergent solution should cover the washing head about ½ inch. It is best to increase the depth of the solution over the washing head to about ¾ inch. This prevents the possible whipping of air into the solution which would produce foam and change the interface between the solution and the soil on the slides.

Finally the washing machine should be checked frequently to see that all bearings have sufficient oil and that undue slipping does not occur due to wear of the bolts or oil on the pulleys.

RECOMMENDED IMPROVED TEST PROCEDURE

As a result of this study the following improved procedure is recommended for determining the percentage of soil removed by a detergent in this washing performance test.

(1) Prepare the Hucker soil by weighing and adding 0.5 gm. of printer's ink and linseed mixture to the batch of soil. The other constituents of the soil may be measured as previously recommended (*1*) (*2*).

(2) With the motor generator turned on the photometer connected to the battery and the clean slides in the photometer adjust the variable resistance to obtain and I_c meter reading of 40. Then remove the clean slides and obtain the reference reading I_o.[2]

(3) Soil the slides by immersing each of them in a predetermined dilution[3] of the soiling agent so that an I_s reading of 15–20 is obtained after their preparation is completed. After immersion the slides are drained 5–8 minutes vertically and 1–2 minutes horizontally and are baked for one hour at 95° C. As stated earlier (2) the baking temperature and time is critical and must be adhered to exactly if reproducible results are to be obtained. After the slides are baked and cooled the photometer reading, I_s, is made with the same reference, I_o, obtained on that set of clean slides.

(4) Place the soiled slides (I_s, 15–20) in the slide holder of the washing machine, fill the washing jar with 0.3 percent detergent solution which has been heated to 60° C. (140° F.) to ¾ inches above the washing head.

(5) Wash for 3 minutes, using a stop watch to obtain the exact washing time.

(6) Remove the detergent washing jar and the excess solution by running the machine for 10 cycles (about 5–6 seconds) with an empty container in place of the washing jar.

(7) Replace the detergent solution with boiling tap water and rinse by running the machine for exactly 2 minutes, timed by stop watch.

(8) Remove the excess rinse water as in No. 6.

(9) Remove the slides to a drying box or rack and permit them to air dry for 15 to 20 minutes at room temperature. Then make the I_w reading with the washed slides in the photometer and with the photometer adjusted to the same I_o reading as for the clean and soiled slides.

(10) Calculate the percentage of soil removed by substituting the logarithms of the proper transmittancy readings in equation 2,

$$R=\frac{\log I_w-\log I_s}{\log I_c-\log I_s}\times 100.$$

If densities are used instead of transmission readings ($D=2-\log T$) a direct arithmetic calculation may be made

$$\left(R=\frac{D_w-D_s}{D_c-D_s}\times 100.\right)$$

(11) Four tests as described using six slides in each test should be made with slides soiled at different times. The results of the four tests calculated as in 10 should be averaged to give a representative washing efficiency rating for a detergent.

The materials used in the preparation of the standard Hucker soil may vary somewhat so the I_s reading obtained in (3) may not fall between 15–20. Consequently it would be advisable to make washing performance tests with borax and castile soap solutions on all batches

[2] It has been found that a Lumentron colorimeter can be easily adapted for this test. If such an instrument is used I_c, I_s and other readings will have different values than are given here.

[3] The proper soil dilution may be determined by making I_s readings on slides dipped in three or more dilutions of the soil and prepared as above. The diluted soiling agent should be strained through one layer of cheese cloth to remove large particles before it is used. The I_s reading is found to be proportional to the concentration of soil. Consequently the results obtained for the different dilutions may be plotted and the dilution required to give the desired I_s reading may be determined graphically. The proper dilution may be easily controlled by means of viscosity measurements. In this laboratory a dilution of 27 percent soil in distilled water which gave a viscosity of 61–62 seconds at 35° C determined in a Saybolt viscosimeter was found to give the required I_s reading.

of soil. In these tests the soil solution should be so adjusted that a 0.3 percent solution of borax will give removals by the above technique of 10.±5 percent and a 0.3 percent solution of castile soap (in a relatively soft water) will give removals of 94±4 percent. The viscosity of the soil dilutions used to get those results should be observed and future dilutions of the same viscosity should be prepared of the same batch of soil for tests on other detergents. If the percentage of soil removal with these two detergents are beyond the ranges given above and all instructions have been carefully followed the soil densities are either too high or too low and the soil dilution for dipping the slides must be readjusted.

If tests are to be made on a series of unknown detergents it would be advisable to make a test or two with these reference detergents during the work to make sure that the soil density is such that results in the proper percentage removal range will be obtained throughout. Reference results for five of the common alkaline detergents are given in table 2 column 4 under the I_s reading 15–20. These data show a performance range from about 11 percent for borax to 94 percent for castile soap.

SUMMARY

The washing performance test procedure proposed by Mann and Ruchhoft (*1*) was studied using a number of detergents to determine possible factors causing variations in the results. It was found that the principal difficulty in the test was caused by variations in the soil thickness on the slides. The data obtained showed that the percentage of soil removed by a detergent under the conditions of the test was a function of soil thickness. The original technique proposed for soiling the slides did not permit the careful control of the soil thickness needed for the test. A new procedure for soiling slides depending upon dipping the slides into a soil dilution of known viscosity was developed which permitted the soil densities to be controlled so as to give light transmittancy readings within a definite zone. Control of the soiled slide densities to a definite range in this matter reduced the standard deviation and coefficient of variation in series of tests on all detergents studied and permitted control of reproducibility and range of performance scale. It was shown that under the conditions of the test the transmitted light readings of the washed slides, I_w were relatively constant for each detergent and were independent of soil thickness. On the basis of this fact estimations of washing performance for a detergent can be made from the washed slide readings only with a standardized technique. A curve for estimating washing efficiency from the washed slide readings is presented.

The method of calculating the percentage of soil removed from four transmittancy readings was made to conform to Lambert's law and a simple formula for making this computation was presented. It was shown that this method of calculation also decreased the variation in a series of performance tests.

Possible errors in the test due to darkening of the light bulb in the photometer with age, and the possibility of variations in the Hucker soil are pointed out and improvements in technique to compensate for these factors are given.

A detailed improved procedure which permits the control of the test to the proper performance range for a series of reference detergents and increases the reproducibility of the results for all detergents is presented.

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STUDIES IN ENTEROCOCCAL FOOD POISONING

I. The Isolation of Enterococci from Foods Implicated in Several Outbreaks of Food Poisoning

By L. Buchbinder, A. G. Osler, and G. I. Steffen [1]

INTRODUCTION

The ability of non-hemolytic streptococci to produce food poisoning in man does not seem to be a matter of dispute. A number of outbreaks have been reported in which members of this group have been implicated (*1*). Although the specific type of the streptococcus isolated has not always been determined (*2*) it is of interest that, apart from three outbreaks reported (*3*), when attempts have been made to identify the causative agent, an enterococcus, usually *Streptococcus faecalis*, has been implicated.

While the disease producing potentialities of the enterococci have long been recognized (*4*) evidence for the etiological relationship of these intestinal streptococci to outbreaks of food poisoning has been relatively limited. Thus Linden, Turner, and Thom in 1926 (*5*) reported the isolation of non-hemolytic streptococci from two food poisoning outbreaks caused by cheese. The organism in each case produced experimental diarrhea in cats. One of these strains was identified by Sherman, Smiley, and Niven in 1943 (*6*) as *Streptococcus faecalis*. In 1934 Jordan and Burrows (*7*) recorded the isolation of an alpha streptococcus from a cocoanut cream pie filling which caused food poisoning. The organism, which produced filtrates toxic to monkeys, was identified as *Streptococcus faecalis* on the basis of carbohydrate fermentations. The authors found that culture filtrates prepared from "greening streptococci" isolated from other sources were not toxic for monkeys. The question of the toxicity of streptococcus culture filtrates is a matter of dispute and has been reviewed

[1] From the Bureau of Laboratories, Department of Health, New York City.

by Dolman (*8*). Dewberry in 1943 (*9*) refers to a food poisoning outbreak caused by canned tomatoes in which a heat resistant streptococcus of "the faecalis type" was present in great abundance and almost in pure culture. Sherman and others (*10*), in a retrospective study, found that a total of six strains of non-hemolytic streptococci isolated by others from an equal number of outbreaks were all *Streptococcus faecalis*. The present authors have identified as *Streptococcus faecalis* an alpha streptococcus isolated in 1939, from turkey dressing by Dack.[2] It was also observed by Sherman and his collaborators that almost any laboratory strain of *Streptococcus faecalis* or of other enterococci could produce diarrhea when fed in pure culture to cats whereas other varieties of non-hemolytic streptococci did not do so. The outbreaks reported in the present paper as well as the demonstration of experimental enterococcal food poisoning in man (*11*) tend to substantiate this evidence for the etiological role of enterococci in food poisoning outbreaks.

This paper describes the bacteriological findings and presents other pertinent data in four outbreaks of food poisoning in each of which enterococci were the predominant organisms isolated from the suspected foods. The offending foods were canned evaporated milk, charlotte russe, roast beef, and ham bologna.

STUDY OF CANNED EVAPORATED MILK IMPLICATED IN AN OUTBREAK OF GASTROENTERITIS

Description of outbreak and clinical findings.—An outbreak of mild gastroenteritis affecting 74 individuals occurred in a children's institution following a meal in which 161 persons participated. The illness, which started within 2 to 7 hours after the meal, was characterized mainly by abdominal cramps, nausea and vomiting. Diarrhea was reported in only two cases. All persons were symptom-free within 6 hours after onset.

Implicated foods.—The only foods eaten in common by all 74 individuals who became ill were mashed potatoes and pasteurized milk. The possibility of solanin poisoning was ruled out by chemical examination of the raw and mashed potatoes which revealed normal values. Canned evaporated milk which had been used in the preparation of the mashed potatoes was suspected as the vehicle of this outbreak.

Bacteriological findings.—Inspection of cans from the implicated lot of evaporated milk revealed many rusted, defective cans such as leakers, springers and swells. Previously unopened cans of milk from this lot were studied using the procedures described in Standard Methods for the Examination of Dairy Products,[3] for the examination

[2] This strain was obtained through the courtesy of Dr. M. J. Surgalla of the University of Chicago.
[3] Eighth edition p. 162–164.

of canned evaporated milk, except that the cans did not receive preliminary incubation for 1 week at 37° C. Duplicate sets of all dilution plates were prepared. One set was incubated at 37° C. and the other at 55° C.

The findings obtained with the milk samples incubated at 55° C. were essentially negative. Only occasional colonies of a thermophilic micrococcus were present. The bacterial counts obtained after incubation at 37° C. are summarized in table 1. Evaporated milk which

TABLE 1.—*Bacterial counts of 43 cans of evaporated milk from a batch implicated in a food poisoning outbreak*

External appearance of can	Number of cans	Number of cans with bacterial counts per ml. of—				
		0–10	11–100	101–1,000	1,001 to 1 million	More than 1 million
Normal	27	4	11	7	3	2
Abnormal	16	2	2	3	2	7

has been properly processed and stored is usually sterile. Occasionally, when bacterial colonies are found, they number less than 10 per ml. As the table indicates, this condition of so-called commercial sterility was present in only 6 of the 43 cans examined. Of the 43 cans, 24 yielded bacterial counts of more than 100 per ml. of which 12 showed no grossly obvious abnormality of the can or the contents. It is noted that nine of the cans, including two which were normal in gross appearance, contained more than one million organisms per ml. These data seem to indicate that under certain, probably rare conditions, evaporated milk poor in sanitary quality may reach the consumer in normal-appearing cans.[4] The abnormal-appearing cans showed evidence of leakage, swelling and rusting, usually with accompanying changes in the appearance and odor of the milk.

Additional studies were made of the contents of 12 of the cans included in table 1 in an effort to identify the contaminating organisms. The findings are summarized in table 2. None of the usual food poisoning organisms were encountered. Members of the genera *Shigella*, *Salmonella* and *Clostridium* were absent, as was also *Staphylococcus aureus*. The cans generally yielded the same types of organisms, the difference between the normal-appearing and spoiled cans being mainly quantitative. The organism most frequently present (9 of 12 cans) and in overwhelming preponderance was a short-chained streptococcus subsequently identified as *Streptococcus faecalis*. Three of the cans yielded a pure culture of this enterococcus.

[4] Some canned evaporated milk was selected at random from retail stores and similarly examined as a means of checking conformance with Standard Methods. Thirty cans representing 14 different brands were studied. Twenty of these were sterile. The remainder showed fewer than ten organisms per ml. This is what is ordinarily found when canned evaporated milk has been properly processed and stored.

TABLE 2.—*Detailed analysis of findings on 12 cans of evaporated milk from a batch implicated in a food poisoning outbreak*

Laboratory No.	Appearance of can	Appearance of contents	Bacterial count per ml.	Number of colonies studied	Identity of colonies			
					Strept. faecalis	Thermophilic micrococci	Other strept.	Miscellaneous
34	Springer and leaker.	Putrid cheesy odor	100,000,000	9	8	1	0	0
36	Swell	Gassy with sour odor	100,000,000	7	6	1	0	0
31	Normal	Normal	Approximately 1,500	3	2	1	0	0
32	do	do	20	2	0	1	0	1
33	do	do	30	2	0	0	0	2
35	do	do	45,000	6	3	1	2	0
37	do	Sl. thickened	36,000	4	4	0	0	0
2	Swell	Gassy and sl. sour	100,000,000	5	5	0	0	0
27	Dented	Normal	Approximately 400	5	0	0	5	0
44	Rim sl. rusted	do	100	6	4	0	2	0
41	Rim sl. dented	do	Approximately 400	12	11	0	1	0
79	Swell	Gassy with cheesy odor	500,000,000	6	6	0	0	0

Identification of the predominant organism as *Streptococcus faecalis* was based on a study of 49 strains which exhibited the following characteristics:[5]

The organism appears as a gram positive, somewhat elongated diplococcus or short-chained streptococcus which produces greening on streaked and in poured sheep's blood agar plates. Milk is acidified and then coagulated. Growth of this streptococcus is readily apparent at 10° C. and at 45° C. Active multiplication proceeds in the presence of 6.5 percent NaCl and of 0.1 percent methylene blue. Gelatin is not liquefied. Exposure to 60° C. for 30 minutes does not completely destroy this streptococcus. Acid without gas is produced from mannite, arabinose, maltose, mannose, amygdalin, trehalose, fructose, galactose, lactose, salicin, sucrose, glycerol. In 1 percent glucose broth, the pH is lowered to 4.6 or less in 3 days. Delayed fermentation of rhamnose and dextrin may occur. Inulin, inositol, dulicitol, adonitol, erythritol, sorbitol, xylose, and raffinose are not fermented.

Inoculation of cans with Streptococcus faecalis.—Experimental inoculation of canned evaporated milk with a pure culture of *Streptococcus faecalis* isolated from a can, followed by incubation at 37° C., gave additional evidence that poor handling may have played a role in initiating the spoilage. It was found that within 24 hours following the introduction of as few as 20 organisms, the resealed cans showed definite bulging at the ends. Gas production was noticed upon opening the cans and plate counts indicated a rapid multiplication of the streptococci. In 1927 Hammer (*12*) isolated a streptococcus from a can of evaporated milk which had bulging ends. He named this organism *Streptococcus distendens*. Hammer found that inoculation of normal cans with this strain and subsequent incubation produced similar swelling. This organism, according to Hammer's description, may be interpreted to have been an enterococcus.

[5] We are indebted to Dr. James M. Sherman of Cornell University who studied six of these strains and also identified them as *Streptococcus faecalis*.

Another perhaps pertinent observation is that of Baumgartner (*13*) who stated in a discussion of canned foods that:

"In the problem of post-process leakage, however, non-gas forming organisms such as staphylococci and streptococci may assume a greater significance in relation to canned food-poisoning. The ubiquity of these organisms makes it possible that occasional cans may become infected and intoxicated without apparent signs of spoilage. According to Davison and Dack (1942), commercial experience is that contamination after processing involves gaseous spoilage. While it is true that in the normal way, the majority of leaky cans are eliminated as "swells" it seems unreasonable to assume that gas-forming bacteria must of necessity be present among the invading bacteria. If staphylococcal or streptococcal species effect entrance unaccompanied by gas-forming bacteria the can will not "swell" and the contents may appear normal in spite of extensive development of the organisms. In view of the ability of organisms of this type to form enterotoxic substances, it seems possible that some of the earlier cases of canned food poisoning, where, in the absence of living organisms of the Salmonella group, the causal agent was considered to be heat stable toxin may have been due to contamination with such organisms as staphylococci and streptococci after processing."

The canned milk involved in the present outbreak had been manufactured about 2 years prior to its use and the deterioration which occurred was undoubtedly influenced, if not entirely caused, by careless post-production handling to which it was subjected during the wartime period.

STUDY OF CHARLOTTE RUSSE IMPLICATED IN AN OUTBREAK OF FOOD POISONING

Description of outbreak, clinical findings, and implicated food.—All three members of a family became ill within 5½ to 12 hours after a meal. The symptoms consisted of abdominal cramps, vomiting, and diarrhea. Charlotte russe (sponge cake topped with a simulated whipped cream) was the only food eaten in common which was suspected on epidemiological grounds.

Bacteriological findings.—Specimens of sponge cake, "whipped cream," skimmed condensed milk from a 40-quart can, and gelatin, all of which were used in the preparation of this product were obtained from the baker's premises and were studied with the following results:

Sponge cake.—The bacterial count was 800 per gram and consisted almost entirely of coliform organisms.

Gelatin.—This product yielded a total count of 3×10^5 organisms per gram with a highly varied flora including some 4,000 coliform organisms per gram.[6]

Prior to its use in the pastry, the gelatin is heated in a double boiler for 15–18 hours. Its possible role in this outbreak is therefore minimized by the prolonged heat treatment. Moreover, bacteriological analysis of the whipped cream containing the gelatin revealed entirely different findings.

[6] Total counts were obtained by use of Standard T. G. E. M. agar. Coliform counts were obtained by use of Desoxycholate agar. See Standard Methods for the Examination of Dairy Products, 8th edition, pp. 23 and 79.

Skimmed condensed milk.—This product obtained from the bakery premises yielded a total count of 54,000 organisms per ml. and a coliform density of 2 per ml. Blood agar plates [7] prepared with dilutions of this milk revealed a seemingly pure culture of alpha streptococci. Six colonies were selected for identification. All six were found to be enterococci, three being *Streptococcus liquefaciens* and three *Streptococcus faecalis.*

Whipped cream.—This product yielded a total count of 1×10^7 organisms per gram and a coliform density of but 20 per gram. Here, too, alpha streptococci were predominant on the blood plates, being present almost in pure culture. The finding that five of six colonies selected at random for study were *Streptococcus faecalis* suggests that the majority of these streptococci were of this type.

None of the specimens contained any enteric pathogens or *Staphylococcus aureus.*

The above data indicate that enterococci may have been responsible for this food poisoning outbreak. The results of the study of two additional condensed milk samples taken subsequently from the same milk plant which served the bakery are of interest. The total count of each sample was approximately 5×10^7 per ml. with non-hemolytic streptococci in great preponderance on the blood plates. Ten colonies from each sample were studied and all were identified as *Streptococcus faecalis.*

STUDY OF BARBECUED BEEF IMPLICATED IN AN OUTBREAK OF GASTROENTERITIS

Description of outbreak.—This was a large outbreak of mild gastroenteritis suffered by a group of people who had partaken of a wedding anniversary dinner.

Clinical findings.—The incubation period generally was 10 to 12 hours, the extremes being 3 and 15 hours. The symptoms were mainly mild. They consisted of abdominal cramps and diarrhea. A few persons had nausea as well, while an occasional individual also complained of vomiting. Recovery took place in from a few hours to a day or two. Only a few persons consulted a physician. Seventy-four (85 percent) of eighty-seven persons interviewed had become ill.

Implicated foods.—Epidemiological evidence ruled out all food but barbecued beef and the gravy served with it. All but 2 of the 74 persons affected had eaten the beef and these 2 had partaken of the gravy. The meat had been roasted over hickory logs on the evening (January 5) before it was consumed. It was left unrefrigerated in the roasting room of the delicatessen establishment from 10:30 p. m. until 11 a. m. the following morning. About 50 pounds of it were then sliced and taken to a synagogue where it remained unrefrigerated until 3 p. m. At that time the meat was placed in pans and heated in a slow oven for 1 hour. The meat was consumed between 4 and 5 p. m. The gravy which was composed of turkey and chicken drip-

[7] Todd Hewitt Agar and Sheep's Blood.

pings had been collected on January 4 and refrigerated until 11 a. m. January 6. It was warmed between 3 and 4 p. m. and served with the meat.

Bacteriological findings.—Samples of the beef and of the gravy, both of which had been refrigerated after the dinner, were obtained on the day following the outbreak. Routine qualitative tests for staphylococci, shigellae, and salmonellae were negative. Tests for enterococci, however, were positive. Quantitative examinations were carried out as follows:

Ten grams of the meat were weighted aseptically, added to 90 cc. of sterile water and macerated in a blending machine for about 5 minutes. The material was then plated out in decimal dilutions in sodium azide agar[8] and incubated overnight. A count of the sodium azide plates revealed a content of about 4.5×10^6 organisms per gram of beef. Twenty colonies from these plates were picked at random, smeared, and stained. It was found that 18 were gram positive diplococci (streptococci), 1 was a gram-negative rod and 1 a gram positive diphtheroid. Twenty-four colonies were fished directly into tubes of nutrient broth. The tubes were held in a waterbath at 60°–61° C. for 30 minutes and then incubated overnight. Streptococci grew in 18 of the tubes. Each of these cultures was then inoculated into test media to determine whether it fulfilled Sherman's criteria for enterococci (*15*). It was found that 17 of the cultures in addition to resisting 60° C. for 30 minutes, grew well in 24 hours at both 10° C. and 45° C., grew in 6.5 percent NaCl nutrient broth and 0.1 percent methylene blue milk, reduced and coagulated Andrade milk, and did not liquefy 20 percent gelatin infusion broth. The eighteenth culture acted in the same fashion except that it liquefied gelatin and digested milk. Thus, 17 of the 24 cultures isolated can be classified as *Streptococcus faecalis* and the eighteenth as *Streptococcus liquefaciens*. If the assumptions are made that 75 percent ± 18 percent (2σ) of the colonies were enterococci, that no appreciable growth in the meat occurred before bacteriological examination, and that the minimum amount of meat eaten per person was about 100 grams (there were actually 50 pounds of meat for 100 persons or more than 200 grams per person), then as many as 2.5×10^8 to 4.0×10^8 organisms could have been ingested per person. This finding is impressive even though the calculation is based on admittedly crude data.

The gravy yielded a count on sodium azide plates of about 3×10^5 organisms per ml. Thirteen of twenty-four colonies picked from these plates and tested as described above were found to be *Streptococcus faecalis*. Thus the *Streptococcus faecalis* count of the gravy was about 1×10^5 to 2.4×10^5 per ml.

STUDY OF HAM BOLOGNA IN AN OUTBREAK OF GASTROENTERITIS

Description of outbreak and implicated food.—Three small outbreaks of gastroenteritis in which the suspected food was ham bologna occurred within short time intervals of each other. It was ascer-

[8] The medium used, except for omission of one ingredient, was that described by White and Sherman (*14*) for the quantitative isolation of enterococci from milk. The omitted substance was penicillin which in our hands was found to be too inhibitory for strains of *Streptococcus faecalis*. The formula which was used follows: 0.5 percent glucose, 0.5 percent tryptone, 0.5 percent yeast extract (Standard Brands), 1.5 percent agar, and 0.03 percent sodium azide.

tained that the ham bolognas were all part of one shipment which had been distributed by a large chain retail grocery company to a number of its stores in the metropolitan area. The company had been notified of additional outbreaks occurring outside of the city and had recalled all of the meat.

Clinical findings.—Nine persons in three families ate the ham bologna and all nine became ill. The symptoms began in 3 to 6 hours and lasted from 3 to 48 hours. They consisted of vomiting, abdominal cramps, and diarrhea. The symptoms on the whole were slightly more severe than those in the three previously described outbreaks.

Bacteriological findings.—Samples of the ham bologna from the three outbreaks were negative for the genera *Shigella* and *Salmonella*. No Staphylococci of the food poisoning type were found in samples from any of the three outbreaks. A sample from only one of the three outbreaks was studied for enterococci. The technic used for isolation and identification of the enterococci was the same as that described for the roast beef outbreak. A count which indicated the presence of 3.5×10^6 organisms per gram of meat was obtained from the sodium azide plates. Seventy-six colonies were cultured in broth. All of these apparently were enterococci by Sherman's criteria. Seventy-two qualified as *Streptococcus faecalis* and 4 as *Streptococcus liquefaciens*. Thus, if the portion eaten is estimated as 100 grams the dose might be 3.5×10^8, which is very similar to that found for the roast beef outbreak.

DISCUSSION

The general impression formed by a study of the literature and the outbreaks reported here is that food poisoning may be more commonly caused by enteric streptococci than has been hitherto believed. It is thus somewhat surprising that enterococci have not been more frequently implicated in outbreaks of bacterial food poisoning since they can be readily isolated from raw and pasteurized milk (*14*) as well as from green Swiss cheese (*16*). They are also found on human hands[9] and are the most abundant streptococci of human feces (*17*), and in addition, grow at refrigerator temperatures. There are, however, several possible explanations for this fact:

1. There might be the inclination to regard *Streptococcus faecalis* as a saprophytic organism whose presence in suspected foods is considered of little significance.

2. There is an apparent tendency, indicated by study of reports submitted to the United States Public Health Service, to implicate the staphylococcus as the only possible remaining cause in those outbreaks where known enteric pathogens are not isolated.

3. In those instances where bacteriological study of a food poisoning outbreak is limited to a search for the well known enteric pathogens

[9] Examination of the hands of 23 persons revealed that those of 7 carried enterococci (*18*).

and the staphylococci, absence of these etiological agents often automatically leads to a designation of the outbreak as one of unknown etiology.

4. The failure to use a fairly rigid quantitative technic in the isolation of bacteria from suspected foods may result in misinterpretation of the significance of those organisms which are actually recovered.

5. As may be inferred from (*11*), it is probable that persons rarely ingest the very large number of enterococci necessary to produce gastroenteritis.

SUMMARY

Evidence is presented which implicates enterococci as the possible causative organisms in four outbreaks of food poisoning of a relatively mild type. The implicated foods were milk products or meats. They were canned evaporated milk, charlotte russe, barbecued beef, and ham bologna.

The literature on the subject of streptococcal food poisoning is briefly reviewed and the possibility of occurrence of similar outbreaks mistakenly ascribed to other or unknown etiological agents is discussed.

ACKNOWLEDGMENT

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We also wish to acknowledge the assistance of Miss Elizabeth Dillon of this Laboratory in the study of the canned milk outbreak.

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COURT DECISION ON PUBLIC HEALTH

Compulsory pasteurization of milk upheld.—The power of a city to require the pasteurization of milk has been upheld in a number of court decisions. Tobey [1] cites pertinent decisions of State courts of last resort. Recently, when the compulsory pasteurization ordinance of Atlanta, Ga., was challenged, Superior Court Judge E. E. Andrews' decision upheld the pasteurization law, and no appeal to a higher court has been made.

Abstract.—(Fulton Superior Court; *F. H. Neely et al.* v. *City of Atlanta, Ga.*, No. A–1323, decided August 26, 1947):

1. The court finds that the ordinance of the city of Atlanta providing that "No fluid milk shall be sold to the ultimate consumer except grade "A" pasteurized milk or certified milk pasteurized" is not oppressive, burdensome, arbitrary, and unreasonable or unconstitutional. Public Health Bulletin No. 220 containing the Milk Ordinance and Code recommended and approved by the U. S. Public Health Service and the U. S. Department of Agriculture, which was admitted in evidence, contains the following:

"The public health value of pasteurization is unanimously agreed upon by health officials. Long experience shows conclusively its value in the prevention of diseases which may be transmitted through milk. Pasteurization is the only measure known which if properly

[1] Tobey, James A.: Legal aspects of milk sanitation, ed 2, Washington, D. C., Milk Industry Foundation, 1947.

applied to all milk will prevent all milk-borne diseases. Examination of cows and milk handlers, while desirable and of great value, can be done at intervals only and, therefore, may permit pathogenic bacteria to enter the milk for varying periods before the disease condition is discovered. * * * Numerous studies and observations clearly prove that the food value of milk is not impaired by pasteurization."

Section 42–401 of the Georgia Code of 1933 provides "* * * the standards recognized and approved by the U. S. Department of Agriculture for * * * milk and milk products shall be adopted as far as practicable * * *."

2. The charter of the city of Atlanta confers upon the mayor and general council all powers over matters respecting the health of the city and said milk ordinance is a valid exercise of the police power of the city of Atlanta, enacted in the interest of the public health unless—

(a) The State legislature has preempted unto itself the legislative field over milk control or

(b) Said city ordinance is in conflict with the statutes of the State.

The State Milk Control Act does not expressly prohibit the enactment of additional local requirements by municipalities in keeping with the purpose of the general law. The State has not so completely occupied the legislative field of milk control as to render any ordinance by the city of Atlanta on the subject inconsistent with the State act. The city of Atlanta, under its general police power over public health may make such new and additional regulations of milk control in aid and furtherance of the purposes of the general law as may seem fit unless in conflict with the State statutes.

The court is of the opinion that the city of Atlanta is not prohibited from enacting the ordinance in question which provides a higher standard of safety for the protection of public health than is provided by the State statutes.

The court finds that said ordinance is not in conflict with the State law or with the rules and regulations formulated by the State commissioner of agriculture which define milk, grade "A" raw milk, pasteurized milk, sterilized milk, cream, buttermilk, etc., but do not expressly permit the sale of any of them in the State of Georgia.

The ordinance of the city of Atlanta fixes a higher standard of safety for milk than does the State law or the rules and regulations promulgated by the commissioner of agriculture but it does not conflict with said rules and regulations or with the State law.

3. Whereupon it is considered ordered and adjudged that the ordinance providing that no fluid milk shall be sold to the ultimate consumer except grade "A" pasteurized milk or certified milk pasteurized is a valid and enforceable ordinance of the city of Atlanta.

The decree was signed by E. E. Andrews, judge, superior court, Atlanta Judicial Circuit.

INCIDENCE OF DISEASE

No health department, State, or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JANUARY 3, 1948

Summary

The incidence of influenza increased from 3,835 to 7,315 cases for the current week, as compared with 3,665 for the same week last year and a 5-year (1943–47) median of 4,587. The increase is accounted for chiefly in the reports of 10 States with 94 percent of the total, as follows (last week's figures in parentheses): Virginia 839 (419), West Virginia 152 (76), South Carolina 1,350 (357), Tennessee 130 (59), Arkansas 212 (44), Louisiana 150 (1), Oklahoma 195 (180), Texas 2,966 (2,015), Arizona 601 (197), California 315 (131). Only 3 other States (Alabama, 83, Colorado, 85, and Oregon, 64) reported more than 24 cases. The total since July 26 (approximate average seasonal low incidence date) is 44,011, as compared with a 5-year median of 36,640, and more than 400,000 each for the corresponding periods of 1943 and 1945.

The total of 46 cases of poliomyelitis reported for the week (last week 61, same week last year 79, 5-year median 52), is less than reported for a corresponding week since 1944 (34 cases). The largest numbers reported currently were 5 cases in California and 4 each in Minnesota and Utah. The total for the 42-week period since March 15 (average low incidence date) is 10,231, as compared with 24,876 for the corresponding period last year and a 5-year median of 13,394.

No occurrence of smallpox was reported for the week. One case of psittacosis was reported, in California. Of 6 cases of Rocky Mountain spotted fever 4 were reported in North Carolina and 1 each in Maryland and Oklahoma. The total of 574 cases of this disease for the 53-week period is the same as for the same period last year and more than for any other corresponding period of the past 8 years. Above the corresponding 5-year medians for the 53-week period are the cumulative figures for the dysenteries (combined), infectious encephalitis, Rocky Mountain spotted fever, tularemia, undulant fever (2-year average), and whooping cough.

A total of 10,418 deaths was recorded for the week in 93 large cities of the United States, as compared with 8,891 last week, 10,209 and 11,928, respectively, for the corresponding weeks of 1947 and 1946, and a 3-year (1945–47) median of 10,209. Infant deaths totaled 716, as compared with 649 last week, and a 3-year median of 664.

Telegraphic morbidity reports from State health officers for the week ended January 3, 1948, and comparison with corresponding week of 1947 and 5-year median*

In these tables a zero indicates a definite report, while leaders imply that, although none was reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median 1943–47	Week ended—		Median 1943–47	Week ended—		Median 1943–47	Week ended—		Median 1943–47
	Jan. 3, 1948	Jan. 4, 1947		Jan. 3, 1948	Jan. 4, 1947		Jan. 3, 1948	Jan. 4, 1947		Jan. 3, 1948	Jan. 4, 1947	
NEW ENGLAND												
Maine	1	3	0	-------	1	1	4	260	25	0	1	2
New Hampshire	0	0	0	-------	1	3	-------	10	6	0	0	0
Vermont	1	0	0	-------	-------	24	2	126	18	0	0	0
Massachusetts	5	21	7	-------	-------	-------	177	247	247	0	3	8
Rhode Island	0	0	0	-------	-------	25	-------	16	7	0	0	0
Connecticut	0	0	1	-------	2	11	15	84	32	4	0	2
MIDDLE ATLANTIC												
New York	16	25	15	[1] 5	[1] 8	[1] 17	267	112	316	6	4	22
New Jersey	3	4	3	-------	4	27	348	120	120	0	1	15
Pennsylvania	7	11	13	(2)	[2] 4	[2] 7	203	778	778	5	1	10
EAST NORTH CENTRAL												
Ohio	15	18	18	7	5	16	251	211	40	3	6	10
Indiana	7	21	13	-------	23	31	693	18	38	1	0	4
Illinois	3	3	10	-------	4	13	799	23	169	4	6	9
Michigan [3]	0	5	3	-------	-------	1	369	126	52	2	4	4
Wisconsin	3	4	4	14	33	62	112	77	77	0	2	2
WEST NORTH CENTRAL												
Minnesota	15	9	4	1	-------	-------	124	6	6	1	0	1
Iowa	1	0	5	-------	-------	2	92	1	21	1	4	3
Missouri	5	8	3	6	1	6	29	6	24	4	2	7
North Dakota	2	3	3	12	2	25	30	2	1	0	1	1
South Dakota	2	0	1	-------	-------	-------	12	7	10	0	1	1
Nebraska	1	0	4	13	-------	60	-------	1	12	1	1	1
Kansas	5	3	4	24	36	36	4	4	46	0	1	1
SOUTH ATLANTIC												
Delaware	0	0	0	-------	-------	-------	6	-------	2	1	0	0
Maryland [3]	4	14	10	4	5	9	3	10	10	0	0	6
District of Columbia	0	0	0	-------	1	5	42	15	9	0	2	2
Virginia	12	3	5	839	615	659	324	86	85	2	1	9
West Virginia	3	12	3	152	65	65	149	22	22	0	6	5
North Carolina	32	8	13	-------	-------	-------	2	160	53	0	2	8
South Carolina	18	18	7	1,350	789	789	13	45	45	0	6	6
Georgia	10	18	13	23	12	181	11	89	19	0	0	2
Florida	10	6	6	16	7	7	13	1	8	1	0	2
EAST SOUTH CENTRAL												
Kentucky	9	21	4	3	3	3	4	-------	66	2	2	4
Tennessee	10	16	10	130	22	89	19	8	39	0	1	6
Alabama	2	8	8	83	69	413	8	27	9	1	2	4
Mississippi [3]	5	14	13	24	-------	-------	5	-------	-------	1	3	3
WEST SOUTH CENTRAL												
Arkansas	9	1	7	212	53	179	23	13	13	1	1	1
Louisiana	4	18	9	150	3	21	3	11	11	1	1	2
Oklahoma	5	2	5	195	90	171	1	10	10	0	1	3
Texas	31	27	48	2,966	1,431	2,250	541	25	90	4	8	9
MOUNTAIN												
Montana	1	1	1	-------	44	44	211	70	38	0	0	0
Idaho	0	1	1	14	19	17	11	4	24	0	0	1
Wyoming	0	0	1	-------	14	14	11	2	3	0	0	0
Colorado	2	8	6	85	22	45	20	2	59	0	2	2
New Mexico	4	1	3	1	2	1	-------	8	3	1	0	1
Arizona	4	7	3	601	209	209	6	64	7	0	0	1
Utah [3]	2	0	0	6	28	32	19	10	14	0	1	1
Nevada	0	0	0	-------	-------	-------	1	-------	4	0	0	0
PACIFIC												
Washington	3	10	10	-------	-------	-------	56	20	25	0	0	2
Oregon	1	3	3	64	25	25	13	29	54	0	0	7
California	9	11	30	315	13	35	256	29	210	14	6	21
Total	282	366	366	7,315	3,665	4,587	5,302	2,995	2,995	61	83	238
53 weeks	12,793	16,560	15,931	345,524	226,837	372,455	221,021	665,967	603,376	3,468	5,721	8,190
Seasonal low week [4]	(27th) July 5–11			(30th) July 26–Aug. 1			(35th) Aug. 30–Sept. 5			(37th) Sept. 13–19		
Total since low *	6,496	7,932	8,771	44,011	36,640	36,640	35,519	25,882	28,893	827	1,055	1,695

[1] New York City only. [2] Philadelphia only.
[3] Period ended earlier than Saturday.
[4] Dates between which the approximate low week ends. The specific date will vary from year to year.
*To obtain figures comparable with the 53-week totals for 1947, to each of the 52-week totals for the years 1942–1946 has been added the respective total for the first week of the succeeding year.

Telegraphic morbidity reports from State health officers for the week ended January 3, 1948, and comparison with corresponding week of 1947 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median 1943-47	Week ended—		Median 1943-47	Week ended—		Median 1943-47	Week ended—		Median 1943-47
	Jan. 3, 1948	Jan. 4, 1947		Jan. 3, 1948	Jan. 4, 1947		Jan. 3, 1948	Jan. 4, 1947		Jan. 3, 1948 [5]	Jan. 4, 1947	
NEW ENGLAND												
Maine	0	1	0	24	48	35	0	0	0	0	0	0
New Hampshire	0	1	0	11	7	6	0	0	0	0	0	0
Vermont	0	1	0	2	12	5	0	0	0	1	0	0
Massachusetts	1	0	0	111	144	261	0	0	0	0	3	1
Rhode Island	0	0	0	2	10	12	0	0	0	0	0	0
Connecticut	1	0	0	22	26	49	0	0	0	0	0	1
MIDDLE ATLANTIC												
New York	2	4	4	139	226	329	0	0	0	1	1	2
New Jersey	0	1	1	31	94	76	0	0	0	1	0	0
Pennsylvania	1	3	0	132	113	197	0	0	0	5	2	3
EAST NORTH CENTRAL												
Ohio	3	1	1	234	284	284	0	1	0	0	4	3
Indiana	2	5	1	53	103	103	0	1	1	0	2	1
Illinois	3	2	0	91	129	213	0	0	0	2	1	2
Michigan [3]	0	1	0	93	165	66	0	0	0	5	1	0
Wisconsin	0	13	1	51	69	145	0	0	0	0	0	0
WEST NORTH CENTRAL												
Minnesota	4	0	0	43	32	53	0	0	0	0	0	0
Iowa	1	2	0	49	17	53	0	0	0	0	0	0
Missouri	0	2	1	38	35	52	0	0	0	1	0	0
North Dakota	0	0	0	11	6	11	0	0	0	0	0	0
South Dakota	0	1	0	2	16	38	0	0	0	0	1	0
Nebraska	0	1	0	14	10	33	0	0	0	0	0	0
Kansas	0	4	0	12	25	80	0	0	0	0	1	1
SOUTH ATLANTIC												
Delaware	0	0	0	6	6	6	0	0	0	0	0	0
Maryland [3]	0	0	0	13	19	43	0	0	0	1	0	1
District of Columbia	0	0	0	4	4	15	0	0	0	0	0	0
Virginia	0	2	1	24	25	55	0	0	0	2	0	1
West Virginia	1	0	0	27	16	40	0	0	0	0	1	1
North Carolina	[6] 7	3	0	45	37	78	0	0	0	1	1	0
South Carolina	0	0	0	14	26	12	0	0	0	0	1	1
Georgia	0	3	1	26	9	14	0	0	0	1	1	1
Florida	2	1	0	7	10	10	0	0	0	1	0	0
EAST SOUTH CENTRAL												
Kentucky	0	0	0	35	40	40	0	0	0	0	2	1
Tennessee	3	0	0	51	15	49	0	0	0	1	1	1
Alabama	0	1	0	11	19	22	0	0	0	0	0	0
Mississippi [3]	0	1	1	11	4	13	0	1	0	1	1	0
WEST SOUTH CENTRAL												
Arkansas	0	0	1	7	3	6	0	0	0	1	0	1
Louisiana	0	3	1	6	4	10	0	0	0	1	4	2
Oklahoma	0	3	1	15	6	25	0	0	0	1	0	0
Texas	1	3	4	32	26	83	0	0	0	2	1	5
MOUNTAIN												
Montana	0	0	0	13	5	13	0	0	0	0	0	0
Idaho	1	0	0	12	13	13	0	0	1	0	2	0
Wyoming	0	0	0	5	5	7	0	0	0	0	0	0
Colorado	1	2	0	29	30	30	0	0	0	1	1	1
New Mexico	0	0	0	10	6	6	0	0	0	0	0	0
Arizona	0	0	1	14	8	10	0	0	0	0	2	0
Utah [3]	4	1	1	12	20	43	0	0	0	0	0	0
Nevada	0	0	0	1	0	0	0	0	0	0	0	0
PACIFIC												
Washington	3	1	3	21	42	45	0	0	0	0	1	1
Oregon	0	0	0	[7] 10	25	25	0	0	0	2	1	0
California	5	12	10	62	86	203	0	0	0	4	2	1
Total	46	79	52	1,688	2,080	3,457	0	3	8	36	38	40
53 weeks	[6] 10,853	25,343	13,791	[7] 85,019	115,061	143,939	169	336	402	3,930	4,041	5,424
Seasonal low week [4]	(11th) Mar. 15-21			(32nd) Aug. 9-15			(35th) Aug. 30-Sept. 5			(11th) Mar. 15-21		
Total since low	[6] 10,241	24,876	13,394	[7] 22,916	28,766	41,778	22	57	95	3,445	3,566	4,608

[3] Period ended earlier than Saturday.
[4] Dates between which the approximate low week ends. The specific date will vary from year to year.
[5] Including paratyphoid fever reported separately as follows: Vermont 1; New York 1; Michigan 1; Tennessee 1; Colorado 1; Oregon 1.
[6] Correction (deducted from cumulative totals): Poliomyelitis, North Carolina week ended November 8, 9 cases (instead of 10).
[7] Delayed report (included in cumulative totals only): Scarlet fever, Oregon week ended December 13, 31 cases.

Telegraphic morbidity reports from State health officers for the week ended January 3, 1948, and comparison with corresponding week of 1947 and 5-year median—Con.

Division and State	Whooping cough			Week ended January 3, 1948								
	Week ended—		Median 1943–47	Dysentery			Encephalitis, infectious	Rocky Mt. spotted fever	Tularemia	Typhus fever, endemic	Undulant fever
	Jan. 8, 1947	Jan. 9, 1946		Amebic	Bacillary	Unspecified					
NEW ENGLAND											
Maine	26	14	19								
New Hampshire	4										
Vermont	47	4	17								3
Massachusetts	125	118	118		1						
Rhode Island	12	11	11								
Connecticut	28	10	31								3
MIDDLE ATLANTIC											
New York	85	166	167	8	2		1			1	3
New Jersey	61	94	91						1		
Pennsylvania	76	158	141								2
EAST NORTH CENTRAL											
Ohio	86	86	86						1		2
Indiana	30	15	15				3		1		4
Illinois	35	70	70	1					10		8
Michigan [3]	68	228	43	3							4
Wisconsin	90	134	86								5
WEST NORTH CENTRAL											
Minnesota	37	1	28				1				7
Iowa	12	5	6								2
Missouri	29	11	11								1
North Dakota		1	1								
South Dakota	2	1	1								
Nebraska	2	3	3	1					1		3
Kansas	29	19	22				1		1		
SOUTH ATLANTIC											
Delaware	1	4	4								
Maryland [3]	27	40	40					1	1		1
District of Columbia	10	6	6								
Virginia	89	75	61	1		39			6		
West Virginia	24	10	18								
North Carolina	48	13	71		2		[3] 1	4	9	(3)	2
South Carolina	131	62	63	2	4				1	1	1
Georgia	7	8	8		1				1	3	
Florida	8	9	9			1				2	
EAST SOUTH CENTRAL											
Kentucky	15	46	20						2		
Tennessee	10	9	12	1					2	2	1
Alabama	13	15	15								
Mississippi [3]				2			1		1	1	
WEST SOUTH CENTRAL											
Arkansas	40	23	22	2					2		1
Louisiana	14	1	2	2					1		
Oklahoma	25		5	1		1		1	1		1
Texas	225	139	145	13	306	246			1	3	6
MOUNTAIN											
Montana	12	1	7								
Idaho	14	5	3								
Wyoming	2	1	5						1		
Colorado	80	6	17								8
New Mexico	4	1	2								
Arizona	36	23	22			43	1				
Utah [3]	5	3	12								
Nevada			1								
PACIFIC											
Washington	16	6	21	1							
Oregon	7	12	13	1		1	1				1
California	49	79	98	1	2		2			1	1
Total	1,796	1,746	1,746	40	318	331	12	6	44	14	70
Same week: 1946	1,746			37	322	473	4	1	51	37	86
Median, 1942–46	1,746			22	322	101	6	0	39	67	[9] 63
53 weeks: 1947	155,601			3,054	17,120	10,145	[3] 639	574	1,398	[3] 1,924	6,143
1946	101,958			2,464	17,034	6,960	621	574	1,230	3,388	5,423
Median, 1942–46	124,927			1,995	18,478	7,668	626	455	838	4,592 [9]	5,133

[3] Period ended earlier than Saturday.

[8] Delayed report, North Carolina: Encephalitis, week ended November 8, 1 case, included in cumulative totals only; correction, typhus fever week ended August 16, 1 case (instead of 2), deducted from cumulative totals.

[9] 2-year average, 1945–46.

Psittacosis: California, 1 case.

Alaska, week ended January 3, 1948: Suspected typhoid fever 2; dysentery 1; colds 10; mumps 1; influenza 3.

Territory of Hawaii, week ended Jan. 3, 1948; Leprosy 1; measles 1; paratyphoid fever 1; endemic typhus fever 1; whooping cough 15.

WEEKLY REPORTS FROM CITIES*

City reports for week ended Dec. 27, 1947

This table lists the reports from 85 cities of more than 10,000 population distributed throughout the United States, and represents a cross section of the current urban incidence of the diseases included in the table.

Division, State, and City	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
NEW ENGLAND												
Maine:												
Portland	0	0	-----	0	-----	0	1	0	3	0	0	7
New Hampshire:												
Concord	0	0	-----	0	-----	0	3	0	0	0	0	-----
Vermont:												
Barre	0	0	-----	0	-----	0	0	0	0	0	0	-----
Massachusetts:												
Boston	5	0	-----	1	33	0	10	0	19	0	1	19
Fall River	0	0	-----	0	1	0	1	0	2	0	1	10
Springfield	0	0	1	0	-----	0	1	0	3	0	0	4
Worcester	0	0	-----	0	1	0	4	0	5	0	0	2
Rhode Island:												
Providence	0	0	-----	0	-----	0	1	0	2	0	0	14
Connecticut:												
Bridgeport	0	0	-----	0	-----	0	0	0	3	0	0	1
Hartford	0	0	-----	0	-----	0	0	0	0	0	0	10
New Haven	0	0	-----	0	-----	0	2	0	0	0	0	1
MIDDLE ATLANTIC												
New York:												
Buffalo	2	0	-----	0	1	0	7	0	7	0	0	15
New York	9	0	3	1	103	0	73	2	35	0	0	15
Rochester	0	0	-----	0	-----	0	1	1	9	0	0	5
Syracuse	0	0	-----	0	-----	0	3	0	3	0	0	9
New Jersey:												
Camden	0	0	-----	0	-----	0	2	0	0	0	0	2
Newark	0	0	-----	0	4	0	2	0	5	0	0	3
Trenton	0	0	-----	0	-----	0	0	0	0	0	0	-----
Pennsylvania:												
Philadelphia	5	0	2	1	21	2	24	0	47	0	0	27
Pittsburgh	1	0	-----	0	2	0	6	0	9	0	0	5
Reading	0	0	-----	1	-----	0	1	0	2	0	0	1
EAST NORTH CENTRAL												
Ohio:												
Cincinnati	0	0	-----	1	13	1	10	0	8	0	0	2
Cleveland	0	0	3	0	1	1	8	0	28	0	0	9
Columbus	4	0	-----	0	24	0	2	0	8	0	0	6
Indiana:												
Indianapolis	0	0	-----	0	6	1	4	0	5	0	0	4
South Bend	0	1	-----	0	-----	0	0	0	1	0	0	-----
Illinois:												
Chicago	0	0	1	0	223	2	23	2	25	0	0	14
Michigan:												
Detroit	2	0	-----	0	7	0	17	0	24	0	1	18
Flint	0	0	-----	0	-----	0	2	0	2	0	0	1
Grand Rapids	0	0	0	1	42	0	2	0	4	0	0	3
Wisconsin:												
Kenosha	0	0	-----	0	1	0	0	0	1	0	0	-----
Milwaukee	0	0	1	1	4	0	3	0	7	0	0	12
Racine	0	0	-----	0	1	0	0	0	2	0	0	1
Superior	0	0	-----	0	-----	0	0	0	1	0	0	5
WEST NORTH CENTRAL												
Minnesota:												
Duluth	0	0	-----	0	1	0	0	0	6	0	0	8
Minneapolis	0	0	-----	0	76	0	4	0	8	0	0	9
St. Paul	2	0	-----	0	2	0	4	0	2	0	0	6
Missouri:												
Kansas City	0	0	1	0	1	0	4	0	5	0	0	6
St. Joseph	0	0	-----	0	-----	0	0	0	0	0	0	-----
St. Louis	0	0	2	0	7	0	12	0	11	0	0	2

*In some instances the figures include nonresident cases.

City reports for week ended Dec. 27, 1947—Continued

Division, State, and City	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
WEST NORTH CENTRAL—continued												
Nebraska:												
Omaha	0	0	------	0	-------	1	4	0	2	0	0	------
Kansas:												
Topeka	0	0	------	0	-------	0	1	0	0	0	0	1
Wichita	0	0	------	0	-------	0	5	0	2	0	0	1
SOUTH ATLANTIC												
Delaware:												
Wilmington	0	0	------	0	-------	0	1	0	6	0	0	------
Maryland:												
Baltimore	2	0	------	0	2	0	4	0	6	0	1	43
Cumberland	2	0	------	0	-------	0	0	0	2	0	0	1
Frederick	1	0	------	0	-------	0	0	0	0	0	0	------
District of Columbia:												
Washington	1	0	1	0	12	1	11	0	4	0	0	3
Virginia:												
Lynchburg	0	0	------	0	-------	0	1	0	2	0	0	3
Richmond	0	0	------	0	-------	0	2	0	4	0	0	3
Roanoke	0	0	------	0	-------	0	0	0	1	0	0	------
West Virginia:												
Charleston	0	0	------	0	1	0	1	0	0	0	0	------
Wheeling	0	0	------	0	1	0	0	0	1	0	0	------
North Carolina:												
Raleigh	0	0	------	0	------	0	0	0	0	0	0	1
Wilmington	0	0	------	0	-------	0	0	0	1	0	0	------
Winston-Salem	1	0	------	0	-------	0	2	0	3	0	0	------
South Carolina:												
Charleston	0	0	4	0	-------	0	2	0	1	0	0	------
Georgia:												
Atlanta	0	0	8	0	-------	0	1	0	2	0	0	------
Savannah	0	0	------	0	1	0	0	0	1	0	0	1
Florida:												
Tampa	0	0	------	1	9	0	3	0	1	0	0	3
EAST SOUTH CENTRAL												
Tennessee:												
Memphis	0	0	5	0	4	0	6	0	4	0	1	1
Nashville	0	0	------	1	-------	0	4	0	1	0	0	------
Alabama:												
Birmingham	0	0	2	0	2	0	3	0	2	0	0	------
Mobile	3	0	11	0	-------	0	1	0	1	0	0	------
WEST SOUTH CENTRAL												
Arkansas:												
Little Rock	0	0	1	0	-------	0	0	0	0	0	0	------
Louisiana:												
New Orleans	0	0	1	0	1	1	6	0	1	0	0	------
Shreveport	0	0	------	0	-------	0	5	0	1	0	0	------
Oklahoma:												
Oklahoma City	0	0	1	0	-------	0	1	0	2	0	0	------
Texas:												
Dallas	0	0	1	1	-------	0	1	0	5	0	0	------
Galveston	1	0	------	0	-------	0	1	0	0	0	0	------
Houston	0	0	------	0	3	0	6	0	1	0	0	------
San Antonio	1	0	1	1	-------	0	3	0	2	0	0	------
MOUNTAIN												
Montana:												
Billings	0	0	------	0	39	0	2	0	0	0	0	------
Great Falls	0	0	------	0	2	0	0	0	2	0	0	------
Helena	0	0	------	0	-------	0	0	0	0	0	0	------
Missoula	0	0	------	0	1	0	0	0	0	0	0	------
Colorado:												
Denver	1	0	1	0	15	1	3	0	5	0	0	10
Pueblo	0	0	------	0	-------	0	0	0	5	0	0	11
Utah:												
Salt Lake City	0	0	------	0	3	1	1	1	0	0	0	------
Washington:												
Seattle	0	0	------	0	3	0	2	0	2	0	0	9
Spokane	0	0	------	0	-------	0	0	0	1	0	0	------
Tacoma	1	0	------	0	23	0	0	0	1	0	0	------

City reports for week ended Dec. 27, 1947—Continued

Division, State, and City	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
PACIFIC—continued												
California:												
Los Angeles	1	0	61	2	11	0	1	1	17	0	0	9
Sacramento	0	0	------	0	2	0	0	0	0	0	1	------
San Francisco	0	0	4	0	65	0	9	0	7	0	0	3
Total	45	1	116	13	775	12	330	7	401	0	6	359
Corresponding week, 1946[1]	91	------	69	23	628	------	337	------	457	0	10	393
Average 1942–46[1]	79	------	1,608	[2] 51	[3] 1,239	------	[2] 469	------	869	0	9	579

[1] Exclusive of Oklahoma City. [2] 3-year average, 1944–46. [3] 5-year median, 1942–46.

Anthrax.—Cases: Philadelphia 1.
Dysentery, amebic.—Cases: New York 6; St. Louis 1; Los Angeles 1; San Francisco 1.
Dysentery, bacillary.—Cases: Worcester 1.
Dysentery, unspecified.—Cases: New York 17; Baltimore 1; San Antonio 1.
Leprosy.—Cases: New York 1.
Tularemia.—Cases: Cleveland 1; Baltimore 1; Birmingham 1.
Typhus fever, endemic.—Cases: New York 2; Los Angeles 6.

Rates (annual basis) per 100,000 population, by geographic groups, for the 85 cities in the preceding table (latest available estimated population, 34,303,300)

	Diphtheria case rates	Encephalitis, infectious, case rates	Influenza		Measles case rates	Meningitis, meningococcus, case rates	Pneumonia death rates	Poliomyelitis case rates	Scarlet fever case rates	Smallpox case rates	Typhoid and paratyphoid fever case rates	Whooping cough case rates
			Case rates	Death rates								
New England	13.1	0.0	2.6	2.6	91	0.0	60.1	0.0	97	0.0	5.2	178
Middle Atlantic	7.9	0.0	2.3	1.4	61	0.9	55.1	1.4	54	0.0	0.0	38
East North Central	3.8	0.6	3.1	1.9	202	3.1	44.4	1.3	73	0.0	0.6	47
West North Central	4.0	0.0	6.0	0.0	175	2.0	68.4	0.0	72	0.0	0.0	66
South Atlantic	11.5	0.0	21.4	1.6	43	1.6	46.2	0.0	58	0.0	1.6	96
East South Central	17.7	0.0	106.2	5.9	35	0.0	82.6	0.0	47	0.0	5.9	6
West South Central	5.1	0.0	12.7	5.1	10	2.5	58.4	0.0	30	0.0	0.0	0
Mountain	8.3	0.0	8.3	0.0	496	16.5	49.6	8.3	99	0.0	0.0	173
Pacific	3.2	0.0	102.8	3.2	164	0.0	19.0	1.6	44	0.0	1.6	33
Total	6.9	0.2	17.7	2.0	118	1.8	50.3	1.1	61	0.0	0.9	55

DEATHS DURING WEEK ENDED DECEMBER 27, 1947

[From the Weekly Mortality Index, issued by the National Office of Vital Statistics]

	Week ended Dec. 27, 1947	Corresponding week, 1946
Data for 93 large cities of the United States:		
Total deaths	8,891	9,380
Median for 3 prior years	9,934	------
Total deaths, first 52 weeks of year	478,066	470,184
Deaths under 1 year of age	646	721
Median for 3 prior years	608	------
Deaths under 1 year of age, first 52 weeks of year	37,892	34,936
Data from industrial insurance companies:		
Policies in force	66,935,951	67,278,078
Number of death claims	8,896	9,065
Death claims per 1,000 policies in force, annual rate	6.9	7.0
Death claims per 1,000 policies, first 52 weeks of year, annual rate	9.2	9.3

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended December 13, 1947.—During the week ended December 13, 1947, cases of certain communicable diseases were reported by the Dominion Bureau of Statistics of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox		40	4	274	306	83	74	71	86	938
Diphtheria		2		37	9			4	6	58
Encephalitis, infectious								1	1	2
German measles		1		9	12	2	3	6		33
Influenza		72			1	3				76
Measles		1	1	453	341	48	34	20	22	920
Meningitis, meningococcus						1		2		3
Mumps		47		198	155	19	185	37	10	651
Poliomyelitis					2	3	1	1	3	10
Scarlet fever	1	3	4	42	71	3	8	8	10	150
Tuberculosis (all forms)		11	3	74	32	20	4	6	56	206
Typhoid and paratyphoid fever				2			1		1	4
Undulant fever				3	2			2	1	8
Venereal diseases:										
Gonorrhea	1	19	13	105	98	22	14	35	81	388
Syphilis		10	3	62	64	10	5	7	26	187
Other forms				1					4	5
Whooping cough				70	29	22	13	65	36	235

CUBA

Habana—Communicable diseases—4 weeks ended November 29, 1947.—During the 4 weeks ended November 29, 1947, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	12		Scarlet fever	2	
Malaria	3		Tuberculosis	8	5
Measles	1		Typhoid fever	13	2

Provinces—Notifiable diseases—4 weeks ended November 29, 1947.—During the 4 weeks ended November 29, 1947, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana[1]	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer	10	19	9	16	1	10	65
Chickenpox		19					19
Diphtheria	3	17	1		1	3	25
Hookworm disease		17					17
Leprosy		2	1	1	3	4	11
Malaria	4	8	2	121	5	10	150
Measles		1		9	6		16
Poliomyelitis						1	1
Scarlet fever		2				1	3
Tuberculosis	21	12	13	33	14	42	135
Typhoid fever	12	24	4	7	5	31	83
Whooping cough		35		30			65
Yaws						1	1

[1] Includes the city of Habana.

FINLAND

Notifiable diseases—October 1947.—During the month of October 1947, cases of certain notifiable diseases were reported in Finland as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	7	Paratyphoid fever	282
Diphtheria	569	Poliomyelitis	40
Dysentery	16	Scarlet fever	221
Gonorrhea	1,426	Syphilis	368
Malaria	2	Typhoid fever	62

GREAT BRITAIN

Poliomyelitis.—For the period May 25 to December 20, 1947, 8,305 cases of poliomyelitis and 642 cases of polioencephalitis have been reported in Great Britain. The following table shows the numbers of cases reported by weeks since the week ended November 15, 1947:

Week ended—	Poliomyelitis	Polioencephalitis	Week ended—	Poliomyelitis	Polioencephalitis
Nov. 15	186	15	Dec. 6	70	6
Nov. 22	142	3	Dec. 13	77	7
Nov. 29	103	3	Dec. 20	55	5

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—Except in cases of unusual incidence, only those places are included which had not previously reported any of the above-named diseases, except yellow fever, during recent months. All reports of yellow fever are published currently.

A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday of each month.

Cholera

Syria.—On January 2, 1948, 1 case of cholera (delayed report) was reported in Damascus area Muhasazet, Syria, making a total of 42 cases and 13 deaths reported up to January 4, 1948.

Plague

Peru.—For the month of November 1947, 9 cases of plague with 6 deaths were reported in Peru by Departments as follows: Ancash Department, 1 case; Lima Department, 7 cases, 6 deaths; Piura Department, 1 case.

Smallpox

Angola.—For the month of October 1947, 50 cases of smallpox with 1 death were reported in Angola.

China—Shanghai.—For the week ended December 20, 1947, 40 cases of smallpox were reported in Shanghai, China.

Libya—Tripolitania.—For the week ended December 20, 1947, 38 cases of smallpox with 11 deaths were reported in Tripolitania, Libya.

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