ROLE OF HOUSEKEEPING
DEPARTMENT IN HOSPITAL SANITATION

# 313 - 66

AUTHOR: R. FRENCH

COMMUNITY SYSTEMS FOUNDATION
Background

The role of the housekeeping department in controlling hospital acquired infections is acknowledged as being of primary importance to the patient. However, there is a divergence of opinion as to the index of effectiveness of the housekeeping department in fulfilling this role. A major reason for this divergence is the vastly different backgrounds of the persons directly concerned with the problem of the hospital acquired infection. Housekeepers have not been trained about the many types of microorganisms and their transmittal to patients. Laboratory personnel, while aware of the technical problems, have difficulty communicating their knowledge in the form of concrete housekeeping programs.

Hospital housekeeping programs vary greatly with regard to method, equipment and supplies, and certainly some of these programs are better than others. For this reason, it is felt that continued study from the laboratory viewpoint and communication of practical programs to housekeeping departments is a vital part of maintaining and improving hospital sanitation techniques. It is the purpose of this paper to explore the literature presently available and to propose a research program sufficient to generate further useful data.
Due to the differing opinions on the index of effectiveness of a housekeeping program, it was decided to present this survey in report form rather than as an evaluation of individual articles. This was necessary for two reasons; the variety of indexes used by housekeeping and laboratory personnel, and the difficulty of obtaining factual data relating specifically to the problem from the housekeeper's viewpoint.
Before examining the role of the housekeeping department in controlling infection, it is necessary to discuss the conditions making a housekeeping department necessary at all.

A hospital is expected to be far cleaner from the esthetic point of view than other buildings. Patients, visitors, and hospital personnel continually cast a critical eye at all phases of the housekeeping department’s operation. Dust and dirt accumulations do great harm to the reputation of the hospital within the community. However, this is not the only reason for a cleaning program. Millions of bacteria exist in the hospital environment with capacity to cause infections and transmit disease to susceptible patients. Disease-causing bacteria affect individual patients in a variety of ways, and since many patients have a low resistance to ward off infection, they must be protected.

Pathogenic, or disease-causing bacteria, are the most dangerous bacteria to the patient as far as presenting a health hazard. However, they exist along with non-pathogenic bacteria and are killed or removed by the same cleaning processes. Thus the term bacteria as used here will apply to both pathogenic and non-pathogenic, or total bacteria. Of the pathogens, Staphylococcus Aureus is the most familiar to the layman and is the cause of a high percentage of hospital acquired infections. Other pathogens present a greater health hazard, but at such a reduced frequency of occurrence that they are not commonly associated with the housekeeping program. Several studies have dealt with control of individual pathogens of particular danger to patients. The results of these studies show that, while certain germicides are better than others for specific
pathogens, the basic method of removal is the same. For maximum protection of patients, it appears that a housekeeping program based on control of all types of bacteria is best. In specific danger areas, germicides can be varied to reduce danger from a particularly difficult pathogen.

It is generally recognized by housekeeping and laboratory personnel alike that sterilization or complete killing of all bacteria is not economically feasible. Disinfection, allowing one bacteria in one hundred thousand parts to live, is also an unreasonable goal due to cost considerations. Therefore, sanitization or reduction of bacteria to a "safe" level is the commonly accepted goal where a goal has been established. One standard defines five to ten bacteria per square centimeter as a safe level. Of course this level is not acceptable for certain hospital areas requiring disinfection or even sterilization.

Bacterial infection may be transmitted to a patient in one or more of the following ways: from another part of his own body, from a previous patient, or from another person within the hospital. The housekeeping department is concerned with transmission from the latter two sources only. Transmission may be either direct or indirect, and both methods may be controlled by the housekeeping department. Danger from direct transmission by housekeeping employees can be reduced by good health habits and personal cleanliness. Indirect transmission is reduced by proper cleaning of inanimate objects capable of transmitting disease called fomites. Linens, utensils, dishes, and portable equipment are just a few of the common hospital fomites.

Indirect transmission via dust and air particles presents one of the

1. LeTourneau, Charles U., M.D., Hospital Floor Sanitation Techniques
greatest challenges to the housekeeping department. When an area is vacated for a period of time, much of the dust and air bacteria settle to the horizontal surfaces, and, in most areas, the floor is the largest horizontal surface. When normal activity begins in the area, bacteria and dust again fill the air. (Cigarette smoke filtering through a room is an example of the dispersion taking place.) Presently, many housekeeping programs are designed to eliminate dust and bacteria from the floor with treated dust mops and damp and wet mopping. However, the cleaning activity itself has placed much of the contamination back into the air where it remains until the cleaning process is finished. It then settles to the floor where some is killed by residual germicidal action, but where most of it remains until the next cleaning. This idea has been expressed quantitatively by air samples showing that bacterial contamination is greatest during and after the cleaning operation. It is not to be inferred that cleaning is not worthwhile. The esthetic goal is satisfied and much of the contamination is removed. However, certain basic cleaning processes must be re-evaluated before an ideal housekeeping system is effected.

The dual goals of the housekeeping program and the conflicts between these goals become apparent when several common hospital practices are illustrated. Many housekeeping personnel feel that a very hard wax or sealer should be used. It is easier to maintain a high gloss and does not need refinishing as often as a soft wax. However, the hard surface tends to repel dust back into the air rather than holding it to the floor where regular floor care can clean effectively. One possible alternative which will satisfy both goals of the program is a water-base, self-polishing wax which can be applied frequently. It is also effectively cleaned with synthetic phenol or quaternary ammonium compounds.
Many hospitals have as common procedure the use of buffing machines to restore a glossy finish to the floor. If this is done immediately after cleaning when the bacteria level is relatively low, there is very little additional contamination placed in the air. However, if buffers are used at other times, the rapid rotation of the brush places much of the floor contamination into the air. Also, it is difficult to clean these brushes effectively or at frequent enough intervals.

The present practice in many hospitals is to mop rooms and corridors with a mop and several buckets of water. This method is inadequate for several reasons. First, the germicide quickly becomes depleted from the mop water. Tests have suggested that the primary value of a germicide is in killing bacteria deposited in the bucket. However, even when extra germicide is used, a point is reached where the bacteria are no longer being killed, but rather are just being put back on the floor. A thin layer of bacteria is formed on the floor which multiplies in the warmth and moisture of the mop. Even if the mop head is changed regularly the bucket will contaminate fresh water unless it is washed well before the next use. Secondly, the cracks in floors and around wall boards are perfect reservoirs for bacteria to remain and grow after a mopping operation. Simply walking across the floor distributes them into the air.

Tests indicate that a better method of floor care involves flooding the floor with clean water followed by a washing operation and a vacuum pick-up. Here the clean solution is separate from the contaminated and the operation can continue until either the clean solution is gone or the contaminated bucket is filled. Water left in cracks is removed with the vacuum operation and the floor is ready to use immediately. Finally, the floor is more effectively cleaned due to flooding the floor with water not merely spreading the dirt and bacteria around.
RESEARCH SECTION
Introduction

It was felt that quantitative data on a number of housekeeping methods for floor cleaning would prove valuable for two reasons; the data would help to substantiate or disprove several theories proposed in the literature survey, and it would suggest additional research for developing practical housekeeping programs. Due to the limited time available, the scope of the experiment was greatly reduced although an expanded research program is outlined. Results of the work thus far strongly indicate that further investigation will provide meaningful data on housekeeping methods and procedures.

I would like to thank Dr. E. M. Britt, St. Joseph Mercy Hospital Bacteriologist, for his cooperation and advice on this project and the use of laboratory facilities. Mrs. J. Johnson, laboratory technician, also contributed much to this work with advice on sterile laboratory procedures. All results are strictly my own and do not imply their agreement in any way.
In recent years, much attention has been focused on the role of the housekeeping department in the hospital asepsis program. Bacteriologists, microbiologists, and housekeepers have become increasingly aware of the many combinations of supplies, methods and equipment that are available to form individual hospital's asepsis program. Considerable amounts of data have been generated by the hospitals with the objective being a high level of bacteriological cleanliness at a minimum of cost. However, it is felt that many times the true total cost of the asepsis program has been obscured because of apparent cost savings in a small portion of the program. To obtain the true total cost each portion of the program must be evaluated in terms of its effect on the other portions. Certainly, the controlling cost in an asepsis program is the amount spent for labor. It is common practice that ninety to ninety-five percent of the housekeeping budget is for wages, while only five to ten percent is for equipment and supplies. With such a high percentage of the budget spent for wages, the optimum combination of supplies and equipment, from a cost standpoint, is generally that which requires a minimum amount of labor.

The development of any housekeeping program is limited by the following restrictions which are questionable in view of the present technology. It is generally accepted that hospitals must maintain a high level of cleanliness from the esthetic viewpoint. However, with sterilization techniques such as ultraviolet light and efficient air filtration systems, which decrease the number of bacteria, this criterion should not carry the importance it now does. Secondly, the safe level of bacterial contamination, as it is now generally defined for housekeeping purposes, includes non-pathogenic bacteria which do not transmit
disease. The safe level could be changed considerably if only pathogens were considered. In spite of these objections, the restrictions will be followed.

A third restriction from the practical aspect is that cleaning must occur during the day. This automatically sets the frequency of cleaning at multiples of one-half day since the work may be done in the morning or afternoon.
In the preparation of the experimental program, it was decided that the following combinations of variables should be tested. Each combination should produce a significant change in either the cost of cleaning or the bacterial level.

<table>
<thead>
<tr>
<th>Method</th>
<th>Variations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mop only</td>
<td>Sterile mop, unsterile mop, phenolic, quaternary ammonium, and iodophore base germicides.</td>
</tr>
<tr>
<td>Mop and rinse</td>
<td>Sterile mop, unsterile mop, phenolic, quaternary ammonium, and iodophore base germicides.</td>
</tr>
<tr>
<td>Mop with wet vacuum pick-up</td>
<td>Sterile mop, unsterile mop, phenolic, quaternary ammonium, and iodophore base germicides.</td>
</tr>
<tr>
<td>Automatic floor scrubber</td>
<td>Phenolic, quaternary ammonium, and iodophore base germicides.</td>
</tr>
</tbody>
</table>

However, an experiment including all of the above combinations would require laboratory work beyond the scope of this project. Each area tested (one area per combination for a total of eighteen areas) would require floor cultures taken for at least three time periods after cleaning. Thus we have fifty-four (18 x 3) cultures to this point. Now it is necessary to prepare from three to four dilutions of each culture for a minimum of one hundred and sixty-two (54 x 3) cultures that must be grown and interpreted. The preparation of the cultures would require three hundred and twenty-four separate pipetting operations. It is easy to see that there are certain practical limits on this type of study.

A modified program was then developed using only the test variables that gave the greatest cost variance. Even under the reduced scope much laboratory work was necessary. The actual test variables are presented in tabular form on the following page.
<table>
<thead>
<tr>
<th>Method 1: Mop and Rinse</th>
<th>1. Hand Mopping</th>
<th>2. Automatic Floor Scrubber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test each area at intervals B,A, 24, 48, 72</td>
<td>No Data</td>
<td>No Data</td>
</tr>
<tr>
<td>Method 2: Mop without Rinse</td>
<td>Test each area at intervals B,A, 24, 48, 72</td>
<td>No Data</td>
</tr>
<tr>
<td>3. Vacuum pick-up</td>
<td>No Data</td>
<td>Test each area at intervals B,A, 24, 48, 72</td>
</tr>
</tbody>
</table>
The practical application expected from this test is based on the following assumption. By varying methods, equipment and supplies, the frequency of cleaning can be decreased without lowering the bacterial cleanliness of the hospital and substantial cost savings will be achieved through reduced expenditures for wages. To evaluate this assumption, it was first necessary to obtain a time vs. bacteria curve for each combination to be tested. From this curve, the frequency of cleaning can be determined. For ease in establishing a program, it was decided to use one day intervals instead of half day intervals. It would be interesting to obtain more data points on the time vs. bacteria curves, although the application of a program with less than one day cleaning intervals would be difficult. From these curves it was possible to develop a cost vs. bacteria curve with each combination tested represented as a single point. It is not expected that the cost vs. bacteria curve will provide the optimum combination at a glance. Further mathematical techniques must be applied before this is possible. Rather, it is expected the curve would provide a basis for intelligent selection of a housekeeping program.

Wage rates vary greatly even among hospitals in the same city. For this reason it is expected that the relative positions of the data points will change for different hospitals. The best program for one hospital might well rank second or third for another. For example, areas with a high wage rate could justify more capital equipment decreasing the frequency of cleaning. Areas with lower wage rates would tend to use more labor and less supplies and equipment.
TEST AREA AND CODING EXPLANATION

- A-B = Area A immediately before cleaning
- B-B = Area B immediately before cleaning
- C-B = Area C immediately before cleaning
- A-A = Area A immediately after cleaning
- B-A = Area B immediately after cleaning
- C-A = Area C immediately after cleaning
- A-24 = Area A 24 hours after cleaning
- B-24 = Area B 24 hours after cleaning
- C-24 = Area C 24 hours after cleaning
- A-48 = Area A 48 hours after cleaning
- B-48 = Area B 48 hours after cleaning
- C-48 = Area C 48 hours after cleaning
- A-72 = Area A 72 hours after cleaning
- B-72 = Area B 72 hours after cleaning
- C-72 = Area C 72 hours after cleaning
**DATA**

<table>
<thead>
<tr>
<th>TEST</th>
<th>1:1</th>
<th>1:10</th>
<th>1:100</th>
<th>1:1000</th>
<th>1:10000</th>
<th>1:1</th>
<th>1:10</th>
<th>1:100</th>
<th>1:1000</th>
<th>1:10000</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-B</td>
<td>17</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B-B</td>
<td>20</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C-B</td>
<td>73</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A-A</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B-A</td>
<td>26</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C-A</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A-24</td>
<td>20</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B-24</td>
<td>88</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C-24</td>
<td>135</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A-1:8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B-1:8</td>
<td>7300</td>
<td>35</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C-1:8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* No of colonies per seven cm².
TIME V. BACTERIA COUNT

**Method 1-1**
Mop and mop with rinse
**Area A**

- Total Bacteria Count per 7 cm²
- Hours after Cleaning

**Method 1-2**
Mop and mop without rinse
**Area B**

- Total Bacteria Count per 7 cm²
- Hours after Cleaning

**Method 2-3**
Automatic scrubber with vacuum pickup
**Area C**

- Total Bacteria Count per 7 cm²
- Hours after Cleaning
COST / 1000 ft²

USING WAGE RATE OF $1.50/HR. 40 G.

HAND MOP AND RINSE

HAND MOP WITHOUT RINSE

SAFE LIMIT OCCURS AT 400 COLONIES

NUMBER OF BACTERIA

COLONIES PER SAMPLE AREA (58 cm²)
Cost Analysis

For determining the cleaning cost, one thousand square feet will be used as the unit of measurement. This is roughly the area of a hospital corridor and is an area for which many standard times are available. Since labor and equipment costs completely overshadow supply cost, and since supplies were not varied in the experiment, they will not be included. Wage rates will be left as a variable, $X for hand mopping, and $X + $0.20 for machine scrubbing, as this job is usually more skilled and pays a premium. The variable $Y$ represents mop and mop bucket cost. Variable $Z$ represents floor machine cost on a ten year depreciation.

\[
\text{mop Only}
\]

\[
\text{Labor Cost} = \left( \frac{20 \text{ min}}{1000 \text{ ft}^2} \right) \left( \frac{X \text{ dollars}}{\text{hour}} \right) \left( \frac{\text{hour}}{60 \text{ min}} \right) = 0.33X \text{ dollars/1000 ft}^2
\]

\[
Y_1 = \text{mop cost + bucket cost (This is negligible)}
\]

\[
Y_1 = (1.52/\text{mop}) (2 \text{ mops/month/floor}) = 3.04/\text{month/floor}
\]

\[
8000 \text{ ft}^2/\text{day} \left( \frac{30 \text{ days}}{\text{month}} \right) = 240,000 \text{ ft}^2/\text{month}
\]

\[
Y_1 = \frac{3.04/\text{month/floor}}{240,000 \text{ ft}^2/\text{month}} = 0.012/1000 \text{ ft}^2
\]

\[
\text{Total Cost} = \text{Labor Cost} + Y
\]

\[
= (0.33X + 0.012)/1000 \text{ ft}^2
\]

\[
\text{when } X = 1.50/\text{hour, total cost} = 0.507/1000 \text{ ft}^2
\]
Mop and Rinse

Labor cost = \( \left( \frac{35 \text{ min}}{1000 \text{ ft}^2} \right) \left( \frac{60 \text{ min}}{1 \text{ hour}} \right) (X \cdot \$ \text{ per hour}) = .584X \)

\( \text{Y}_2 = 2Y_1 \cdot 2(0.012) = \$0.024/1000 \text{ ft}^2 \)

Total cost = Labor cost + \( \text{Y}_2 \)

\( = .584X + \text{Y}_2 \)

\( = (0.584X + 0.024)/1000 \text{ ft}^2 \)

When \( X = \$1.50/\text{hour} \), total cost = \$896/1000 \text{ ft}^2

30" Automatic Floor Scrubber

\( \frac{20000 \text{ ft}^2}{60 \text{ min}} = \frac{3 \text{ min}}{1000 \text{ ft}^2} \)

Labor cost = \( \left( \frac{3 \text{ min}}{1000 \text{ ft}^2} \right) \left( X \cdot \$ \right) \)

\( = .05(X + 0.20) = \)

\( = (0.05X + 0.01) \frac{\text{dollars}}{1000 \text{ ft}^2} \)

\( Z = \$2000 + (\$200/\text{yr})(10 \text{ yr}) = \$4000/\text{yr} \)

\( = \$400/\text{yr} \div 365 \frac{\text{days}}{\text{year}} = \$1.09/\text{day} \)

\( \approx \$1.09/\text{day} \div 8 \frac{\text{hrs}}{\text{day}} = \$0.14/\text{hr} \)

\( Z = \$136/\text{hour} \div 2000 \text{ ft}^2/\text{hour} = \$0.068/1000 \text{ ft}^2 \)
\[ \text{Total Cost} = \text{Labor Cost} + z \]
\[ = (0.05x + 0.01 + 0.0068) / 1000 \text{ ft}^2 \]

When \( x = \$1.50 / \text{ft}^2 \), Total Cost = 0.075 + 0.01 + 0.0068
\[ = \$0.0918 / 1000 \text{ ft}^2 \]
Experiment Conditions

Since the index of cleaning effectiveness is the number of bacteria per test area, it is necessary to reduce contamination from the test environment as much as possible. Air bacteria and non-sterile laboratory apparatus will vastly influence and distort the results if proper precautions are not taken. For this reason, standard laboratory procedures will be used at all times as well as the following procedures unique to this study. It is realized that further study is necessary before applying the idealized test conditions to actual practice.

1. Freshly laundered mop heads will be used for each area tested throughout the experiment.

2. Mop buckets will be disinfected before cleaning each test area and filled with fresh water and germicidal solution.

3. Standard amounts of germicide will be used for each method variation, (two ounces of vesphene per gallon of water)

4. To insure uniform method the same personnel will perform the cleaning for each trial.

5. Calcium alginate wool swabs, dissolvable in a sodium citrate and saline solution, were used in place of ordinary cotton swabs to allow approximately ninety-seven percent recovery of bacteria.

6. Swabs were autoclaved for fifteen minutes as was the dissolving and diluting solution mentioned above.

7. Culture dishes were taken upon use from pre-sterilized packs.

8. The growing medium introduced into the culture dishes was autoclaved for fifteen minutes before use.

9. Pipettes were autoclaved for fifteen minutes and flamed before use as is common in sterile laboratory procedure.
Experiment Procedure

1. Prepare a growing medium by adding forty grams of trypticase soy agar to one liter of water and boiling to dissolve. Autoclave the solution for fifteen minutes and hold at 50 degrees centigrade to avoid a gel from forming until ready for use.

2. Clean floor areas marked A, B and C using the respective method assigned to each.

3. Approximately five minutes after cleaning, place a template with a fifty-eight square millimeter hole cut from it in the approximate center of the test area.

4. Uncap a sterilized test tube containing the calcium alginate wool swab. Also uncap a sterilized test tube containing ten milliliters of the sodium citrate and saline solution. Dip the swab into the solution and wipe the area within the template using increasing circular strokes. Return the swab to the solution and replace the cap. Follow this procedure for each of the three areas.

5. Shake the three test tubes until the swabs are completely dissolved. This solution now contains the bacteria in ten milliliters of sodium citrate and saline solution and is referred to as the undiluted strength.

6. Using sterilized pipettes, draw one milliliter of undissolved solution and place it in nine milliliters of sterilized sodium citrate and saline. This dilution is now 1:10. Repeat for each of the three areas.

7. Draw one milliliter from the 1:10 dilution and place in another sterilized sodium citrate and saline solution containing nine milliliters. This dilution is 1:100. Repeat for each of the three areas.

8. Repeat the above process to form a 1:1000 dilution for each area.
9. From each of the four dilutions (undiluted, 1:10, 1:100, 1:1000) pipette one milliliter of solution into a sterilized culture dish. Add enough growing media to fill the dish and cover the dish. Gently swirl the dish until a gel forms.

10. Place the dish in an incubator for forty-eight hours at 98.6 degrees Fahrenheit at the end of this time remove the culture dishes and with the aid of a magnifying glass and automatic counter, tabulate the number of bacteria cultures that have grown.

Since we are comparing the number of bacteria colonies per square centimeter the size of the sample area within the test area is immaterial as long as it is known. However, it should be realized that the one milliliter of undiluted solution represents one-ninth of the bacteria colonies present in the sample area (58 cm²). To obtain the projected number of colonies for the entire test area (100,570 cm²), we must multiply by 1,740 (100,570 ÷ 58).
Conclusion

While experimental error in the actual laboratory work appears to be at a minimum (as shown by the lack of bacteria in the 1:100 and 1:1000 dilutions where we know no significant growth should appear), it is strongly recommended that a laboratory technician perform the tests and prepare cultures. This will give added confidence to results and insure greater uniformity in laboratory work.

There is one serious flaw in the preceding analysis that will require further research to overcome. Bacteria count in any given area after a certain time period is heavily dependent on usage of the area. Thus it will be necessary to make certain the time vs. bacteria curve takes the variable usage into account.

In the present set of data area C is located near the entrance to a much used conference room. Thus the bacteria count was greater than at any other portion of the hall.

To substantiate the data obtained from the experiment and correct the error made in placing only area C near the entrance to a room further tests are planned in the near future. Laboratory personnel will be used and it is hoped that at least two more complete sets of data can be obtained and analyzed before attempting any conclusions.
Bibliography

A. Primary Sources

Hurst, Valerie, "The Role of Housekeeping in the Control of Staphylococcal Infection", Hospital Topics, October, 1958.

Walter, Carl W., "Infection Lurks in the Janitor's Closet", The Modern Hospital, May, 1958.


"Control of Hospital Infections by the Housekeeping Department", Hospital Topics, July, 1963.


"Housekeepers Responsibility in the Battle Against Infections", Hospital Progress, June, 1958.

The Modern Hospital, October, 1963.

B. Secondary Sources

The Modern Hospital, January 2, 1964

The Modern Hospital, March, 1964

Hospitals, August 16, 1964

Hospital Progress, February, 1963