

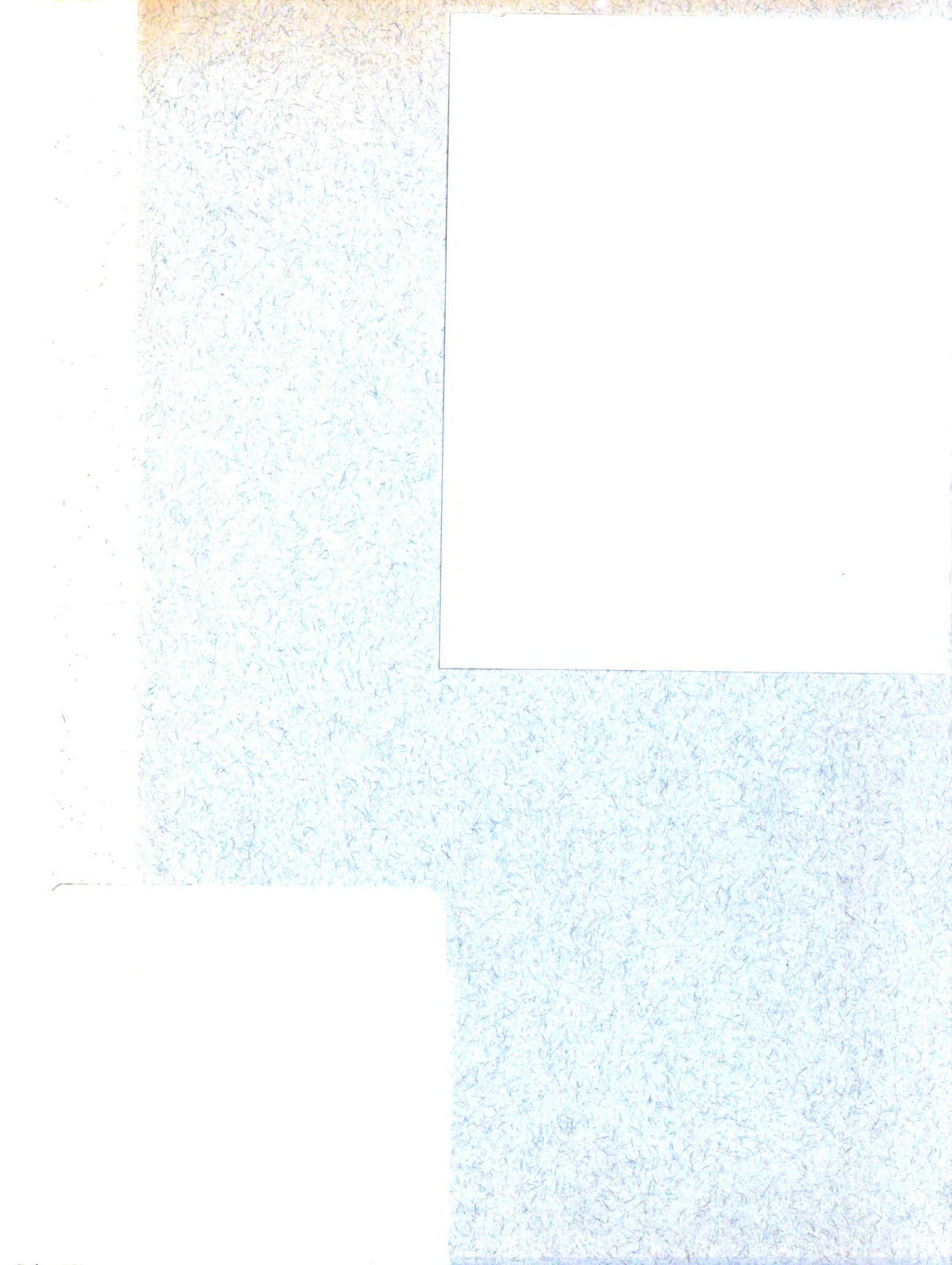
A LIMITED SURVEY OF RESEARCH STUDIES
AND PERTINENT MATERIAL BEARING
UPON THE PROBLEMS OF THE
CARDIAC HOMEMAKER

Ruth Cresswell Kettunen
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A Limited Survey of Research Studies and Pertinent Material
Bearing Upon the Problems of the
Cardiac Homemaker

By Ruth Cresswell Kettunen

A Report

Submitted to the School of Graduate Studies
of Michigan State College of Agriculture
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Department of Home Management and Child Development
School of Home Economics
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The writer wishes to express sincere appreciation to Dr. Irma Gross for her guidance and encouragement in the preparation of this paper and to the Michigan Heart Association which through its initiation of, and support of, a cardiac homemaker's program in Michigan suggested to the writer the need for this kind of material.

INTRODUCTION

A SURVEY OF RESEARCH STUDIES AND PERTINENT MATERIAL BEARING UPON THE PROBLEMS OF THE CARDIAC HOMEMAKER

In submitting the material tendered in this paper, the writer has in mind giving some practical help to the person who is interested in teaching the woman with heart disease simplified ways of doing her housework. The systematic, practical yet scientific approach to methods of performing housekeeping tasks, is comparatively new. This approach received its impetus from Dr. Lillian Gilbreth, who with her husband, the late Frank Gilbreth, were pioneers in the movement in industry. The American Heart Association can be proud that Dr. Gilbreth chaired the subcommittee that developed the plan for the application of the principles of work simplification to the particular needs of the cardiac homemaker. It is hoped that those who teach these precepts will teach in such a way as to emphasize that techniques and improved methods are a means to an end. The end result desired for the cardiac homemaker is available strength and energy and time for her important job of homemaking. Dr. Gilbreth expressed this philosophy in the opening sentence of her book, The Homemaker and Her Job, when she stated "Homemaking is the greatest job in the world".

The idea for this survey developed as the writer was preparing to teach cardiac homemaker's classes in Michigan. In setting up the class program and selecting recommended

practices to teach and demonstrate, it seemed that such teaching could only be done with confidence if more were known as to how such information had been ascertained.

As the writer obtained such knowledge she found that she was teaching with more confidence and enthusiasm. It was felt that a comprehensive view of literature related to this problem would benefit the person making such a study, and it in turn might also be of great help, and a saver of time, to others planning to do similar teaching.

In starting, the first step was to consult faculty members in several departments at Michigan State College. Staff members in both the men's and women's physical education departments, the physiology, psychology, industrial engineering, and home management departments were interviewed. These interviews proved most helpful. Suggestions were given about studies in their particular fields that could be used and also information as to sources for finding such reports.

A day spent at the United States Department of Agriculture's Experimental Center at Beltsville, Maryland gave first hand information as to the research being carried on there in home economics projects. The personal interviews with the research workers at this center, as well as with members of the Home Economics Extension Staff in Washington, proved to be most helpful. Conferences with some doctors of medicine provided further useful information.

Letters were written to individuals through the nation and even to some in European countries who were known to be

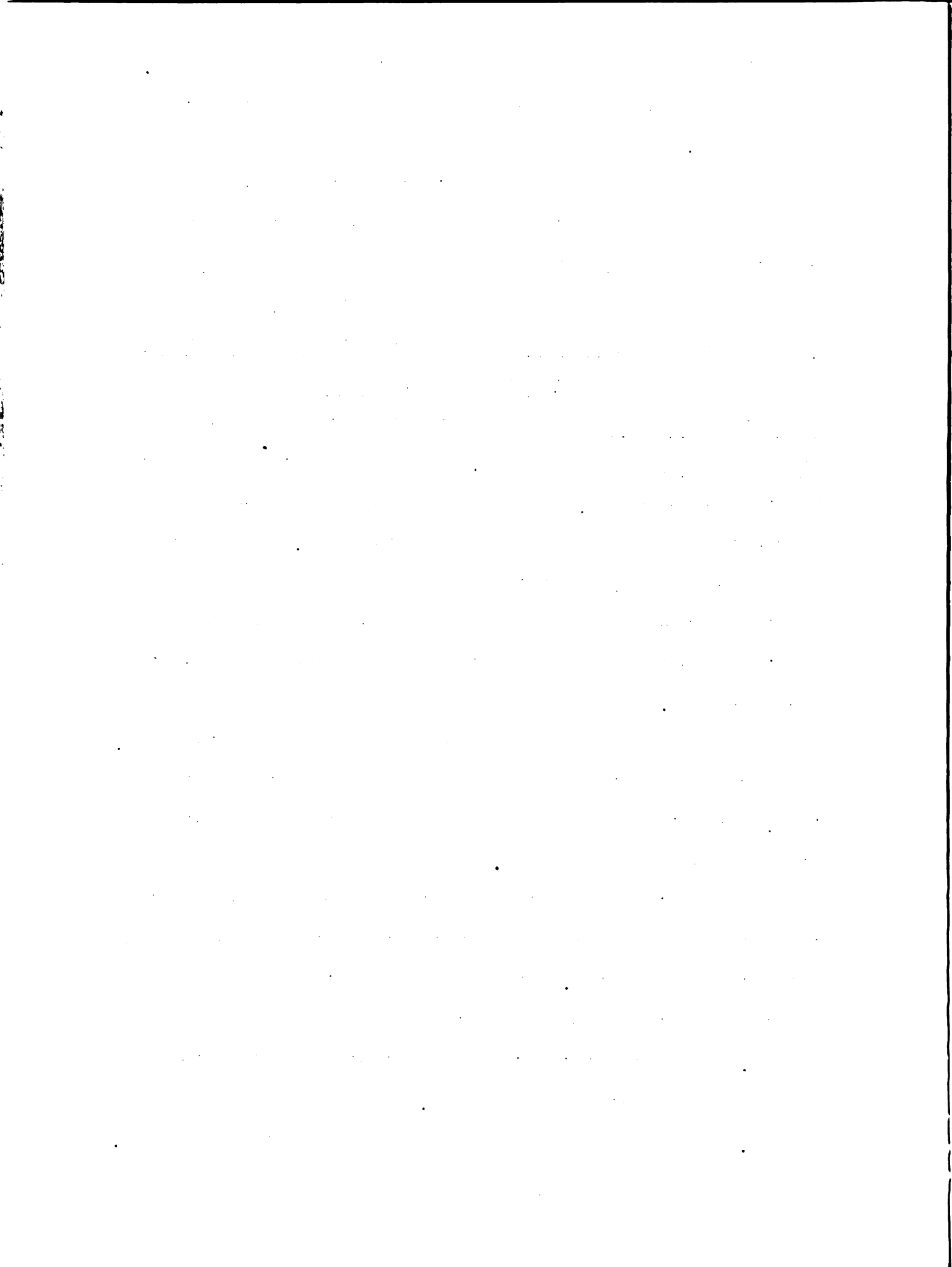
authorities on some phases of the subjects being surveyed. Response from these letters provided a variety of useful suggestions.

The main sources used for finding suitable research studies and other published material were bibliographies supplied or suggested by those authorities contacted, and such publications as The Journal of Physiology, The Journal of Home Economics, The Quarterly Cumulative Index Medicus, Notes on Graduate Studies in Home Economics and Home Economics Education, and the published lists in Doctoral Dissertations, were also used. Twelve unpublished master's thesis were reviewed, as well as reports of others found in professional journals and other publications. It was found that there was a very limited number of these research studies that could be used for this survey but other published articles and bulletins seemed to have a place in such a report.

As an attempt was made to use only recent publications, most of the material reported on has been published since 1940, exceptions were made when the material had special significance to the problem.

The studies and articles reviewed have been categorized into nine sections with the publications listed chronologically in each section. The research studies and other published articles are classified as follows:

1. Work simplification, the principles and their application to housework.
2. Energy expenditure in various household activities.



3. Posture and correct body mechanics in relation to housework.
4. Fatigue with reference to the cardiac homemaker.
5. Vision and its bearing on the problems of the cardiac homemaker.
6. Research studies of specific household activities.
7. Kitchen planning.
8. Publications with reference to handicapped and cardiac homemaker's problems.
9. The heart, heart diseases, and treatment.

No attempt has been made to balance the quantity in the different sections. The writer reported on material she found available and thus some sections have much more than others. In some cases the articles reported here are similar, but by doing this the reader will have a variety of sources to refer to. The writer does not feel that these condensations submitted are complete in this particular field. They are offered as one possible source of help to the person who is interested in teaching work simplification. It is hoped that this material will be used as a point of departure in gaining greater interest in the fields of research that have significance in teaching work simplification to women who have heart disease, or to other homemakers.

SECTION I

WORK SIMPLIFICATION, THE PRINCIPLES AND THEIR
APPLICATION TO HOUSEWORK

Work simplification has been defined as a more effective way of doing a job that results in the use of less effort, less time or both. The principles of work simplification have for more than half a century been applied to the problems of industry. The present trend of the "American Way of Life" has been influenced by the industrial productivity resulting from the application of these principles. Yet it has only been for half that time that these scientific principles have been applied at all to housework. The precepts of work simplification used in industry and in the home are identical. It is only the goals that are different. In industry the primary aim of time and motion study has been to increase productivity for the sake of profit. In the home the ultimate goal is homemaking. As the homemaker applies these principles to housekeeping tasks and develops new and better techniques, the job becomes more interesting and time and energy are made available for her overall job of homemaking. The cardiac homemaker has still another goal. As she puts into practice these energy saving methods of doing her work, she learns how to meet the demands made upon her in her home in such a way as not to overtax her incapacitated heart and this change can mean life itself to her.

For the reader who wishes more complete information than the articles in this section give, the texts listed below are suggested.

Mundel, Marvin E., Motion and Time Study,
Prentice-Hall, Inc., New York, 1950.

Gross, Irma H. and Crandall, Elizabeth Walbert,
Home Management in Theory and Practice,
Ch. 6 and 7, F.S. Crofts and Company,
New York, 1947.

Nickell, Paulena and Dorsey, Jean Muir,
Management in Daily Living, Ch. 11, 12 and 13,
John Wiley and Sons, Inc., New York, 1950.

There are six abstracts in this section. Four of these came from research done at Purdue University. One of the Purdue publications, Easier Homemaking, brings together the results of much of the work done there in a practical presentation. An additional article gives a brief general view of work simplification. Finally, there is included in this section a bulletin, Household Cleaning.

It is not the purpose of this survey to include subject matter bulletins that give instructions for doing special jobs because state colleges, the educational divisions of many commercial companies and the United States Department of Agriculture provide a wide variety of such information. This bulletin, however, is included as an illustration of presenting such material in a way that stresses that the prime factor in cleaning is to save energy for the homemaker.

Gross, Irma H., The Theory of Work Simplification, Kelvinator Kitchen, Detroit, 1944.

During the period of World War II, farm management and home management specialists followed the lead made by industry of utilizing easier and quicker methods of work. The name of the movement toward decreasing effort went through various changes, finally evolving the title of work

simplification. In research in work simplification the worker on the job is observed and then improvements are sought in the detailed elements of the job. Special process charts, operation charts, stop watch techniques and a kind of shorthand symbols called "therbligs" are employed. A film of the job is taken and then the process can be analyzed in even greater detail. The number of household and related tasks that have been studied are very limited. Those known to the author are washing dishes, preparing lettuce cups, preparing spinach for cooking, preparing mashed potatoes, peeling tomatoes under factory conditions and some analysis of janitors' cleaning tasks. The homemaker can use the results of these studies to find easier methods of doing a particular task and can apply the principles of work simplification to her own job. It is necessary to know these principles. Time is lessened on a task by reducing the number of motions, having more effective motions or both. There are five classes of changes possible: changes of body motions and position, changes in tools and equipment, changes in production sequence, changes in finished product and changes in raw material. Some searching questions chiefly in relation to class I changes are: can you cut down on the number of motions; can you combine motions by prepositioning; can you simplify work by changing the direction of your motions; can you change the kind of motions used; and can you reduce work by using both hands at once? In adopting a program of work simplification for one's self the first step is to see some reason for so doing. Second, it is necessary to recognize that changing old habits is not a quick nor a

particularly easy process. Attack the new habit boldly and keep with it until it becomes an old friend. After this, ask why do I do the job; can I do it in a more convenient place; can I get better tools; am I using the best tools I now have; is my body position comfortable; or could I use my hands more effectively? Accepting such suggestions points the way to becoming more motion-minded. This state of mind is not a goal in itself but a constant incentive to newer, more interesting and more effective ways of accomplishing everyday tasks.

Goble, Eva L., Techniques of Work Simplification, Kelvinator Kitchen, Detroit, November 1945.

Techniques of work simplification are important in home economics because they offer a scientific means of studying household tasks. The productivity of the homemaker's labor is best measured in terms of her contributions to family living and work simplification becomes of major importance in terms of her productivity.

The first step in work simplification is to become motion conscious. Six guides to apply to make a job easier are to ask: is the job necessary; can it be combined with some other task or the two done at once; can the task be done while seated; are the tools to use within easy reach; is it possible to use both hands to work; and is this the best tool for the job?

The second tool of work simplification is the use of special charts. The process chart is a step by step description of the procedure used in doing a task. The process chart teaches the user to think in terms of the "flow"

or movement of work. As a tool for analysis, it is one of the most useful for rough screening of excess travel and repeated effort. Further screening of waste motion can be obtained by the use of an operation chart. In this, the movements of the operator are broken into the activities of the right and the left hand. In the final analysis micro-motion techniques are used. This works best when the task can be localized and a motion picture taken. The picture is then studied and analyzed. A special clock provides a device to have time readings for the movements recorded in the film. Each motion is analyzed from this film and the motions are described in terms of therbligs, a system of terms developed by the Gilbreths, pioneers in motion study. After this analysis the elements are transferred to a simo-chart on which each therblig is given an identifying color. This simo-chart is an aid to spotting places in a process or operation where movement is excessive or where "delay" needs study. Micromotion is exacting and requires elaborate equipment but the process and operation charts are simple to use and require no special materials. Therefore the latter are good devices for use to promote more efficient kitchen operation.

Holbert, Helen Elizabeth, The Adaptation of Work Simplification Methods to Household Activities, Master's Thesis, Purdue University, Lafayette, 1945.

The introduction of this study provides a thorough and scientific discussion of work simplification in its relation to homemaking. The body is the most effective tool for effecting work. Since the body is a standard tool, then the problem in the home consists in finding the movements best

suiting to accomplish work. The study of and the understanding of body mechanics is necessary. The author uses charts and drawings as aids in providing this understanding. The common techniques of motion and time studies are not extensive enough for the study of household activities which involve much body movement with changes of position and place. Since the available means were not adequate, the author worked out further methods of work analysis and these were applied to the task of bedmaking. The new method of bedmaking resulting necessitated a change of bedmaking method, changes of bed height, and of working techniques. This method is illustrated by photographs, drawings and detailed process charts. The author concludes that because of the common bed design a great deal more energy is utilized in bedmaking.

This new method may not be practical under conditions other than those she established for the study but the working techniques (use of human tool methods) are easily applied under most conditions. The purpose of the study has been to shift from the objective outcome of industry; that is, increased production and time saving, to the objective outcome of effort saving. Engineers have designed machinery and tools that work effectively and efficiently but much work output necessitates the addition of the human tool so it is important to consider it with the machine.

Mundel, Marvin E., Easier Housekeeping, Life Magazine, September 9, 1946.

This article, Reported Research of Janet Armstrong Under the Direction of Marvin E. Mundel, shows the basic principles

of work simplification applied to kitchen tools, kitchen arrangements, cleaning and bedmaking. To help visualize the researcher's findings, multiple-exposure photographs were taken of experimenters doing household tasks with small light bulbs attached to their hands. This process traced the pattern of the working motions in streaks of light. By showing the poor and the improved methods, the reduction in streaks of light in the improved method shows dramatically the economy of movement. Six rules for efficiency in the home are given. These rules are: eliminate all unnecessary parts of a job, keep everything within easy reach, use the best tool for the job, use both hands to work, combine two jobs into one, and sit down to work. Six steps are given for making a bed in an improved way. A photograph illustrates each step. Essential kitchen tools are pictured, grouped around each basic piece of equipment (range, refrigerator and sink) where they are most used and near which they should be stored. Nine pictures illustrate a selection of gadgets that are rated as a good choice and similar ones considered poor. Four questions are given that should be asked when evaluating a gadget: is it easy to operate; does it require a special skill; does it save time, counting the time necessary to get it out, clean it and put it away; can it be used for more than one job; does it warrant the space it takes up? Rules for ironing a shirt are given that can save 50 percent of ironing time (as worked out at Cornell University). It was recommended that the worker sit with the underside of the ironing board two inches above the

thighs. The board should be covered with asbestos and should be approximately two feet wide. Life Magazine asked the Motion and Time Study Laboratory of Purdue University to do this piece of research reported here, believing that a housewife's work can be simplified through scientific analysis.

Mundel, Marvin E., Easier Homemaking, Experiment Station Bulletin No. 529, Purdue University, Lafayette, 1948.

The purpose of the project reported was to apply work simplification principles to various aspects of kitchen arrangement, house cleaning methods and bedmaking procedures. This publication approached the problem from the practical viewpoint, realizing that each home is individual and must be treated as such. However, there are six principles that can be applied to any house and to any worker. Basic suggestions are given for making housework easy. There are various ways of recording original and improved methods of doing a job and in this study, process chart-man analysis, flow diagram, right and left hand operation chart and micro-motion study were used. Kitchen shapes and arrangements show that the "U" shaped kitchen is the best plan for economy of time and economy of distance traveled. As a result of research, a list of essential kitchen tools and small equipment are given that should be placed convenient to each kitchen work center. Various tasks have been studied and improved methods are given for ironing, making a bed, washing woodwork, cleaning a bedroom, waxing floors, dusting, mopping and dishwashing. Household gadgets were evaluated and a check list given. Gadgets were classified according to their efficiency. A floor plan is given for "The Kitchen of

Tomorrow". Process charts were used in an analysis of meal preparation and these results showed that a person would walk only 116 feet in preparing a meal in this kitchen and the same preparation would require 448 feet of walking if done in the conventional "U" shaped kitchen.

MacDonald, Jessie Freeman and Williamson, Lucille, Household Cleaning, Extension Bulletin No. 790, Cornell University, Ithaca, August 1950.

This bulletin outlines the problems of household cleaning and then gives a variety of special and specific directions for care of special surfaces. The authors' approach to the problem of housecleaning is that help should be given to the homemaker to aid in reducing the amount of cleaning and the effort necessary to do it. The amount of cleaning a homemaker does will be determined by her own and her family's standards as well as other responsibilities, help available from other family members, her health and various resources available to her, such as money, equipment and commercial services. As these conditions change, so will her care of the house change. Each homemaker must decide for herself how much cleaning she will do, when, how frequently and what methods she will use. A flexible plan for cleaning best meets the needs of most households but one should look ahead and plan to make the job easier and more interesting. The annual cleaning often leaves the homemaker physically and emotionally exhausted, so it is suggested that the special cleaning jobs be distributed over a period of time. To make cleaning easier, plan ways of keeping dirt out of the house, plan for adequate storage spaces, select suitable supplies

and equipment and select surfaces that are easy to clean.

Preventing excessive fatigue is a primary consideration and since all cleaning involves muscular activity, the best possible use of muscles is important. Frequent short rest periods between heavy jobs prevents excessive fatigue and it is also a good plan to alternate easy and hard jobs. The care of specific surfaces given in the bulletin give a wide variety of aids to better housekeeping.

SECTION II

ENERGY EXPENDITURES IN VARIOUS HOUSEHOLD ACTIVITIES

A very limited number of research studies are available that give specific information that can be applied to the problem of saving energy when performing household tasks. In the other sections of this survey, in most cases only the most recent studies and publications have been included, but in this section reports of the first studies reported are included. This has been done because of the fact that the work of the more recent research workers used these original studies as a basis and then carried on their investigations from the point where the first studies ended. All articles in this section are research findings. There are ten articles condensed and they indicate the progress of research in this field.

The important fact to remember when considering the results reported is that regardless of the scope and accuracy of the research, energy measurements cannot be taken as a positive measurement that applies to everyone. There is a great variation between persons, and thus there are different energy costs for different individuals doing the same tasks. Even the same individual uses different amounts of energy to perform the same task at different times. Changed emotional factors, fatigue, and changed environmental factors are the cause of such differences. For this reason energy measurements should be used with discretion. If one uses such information, accepting the possibility of rather wide variations due to these factors, then energy measurements become an excellent tool for pointing out the importance of

effective body motions as a way of saving energy.

Energy research can be much better understood and interpreted if one has a thorough knowledge of the methods used and equipment necessary for doing this type of research.

The texts listed below provide such information.

Rose, Mary Swartz, Foundations of Nutrition,
pp. 7-19, The MacMillan Company, New York,
Revision 1944.

Chaney, Margaret S. and Ahlborn, Margaret,
Nutrition, pp. 34-49, Houghton Mifflin
Company, New York, 1949.

Benedict, Francis G. and Johnson, Alice, Energy Loss of
Young Women During the Muscular Activity of Light Housework,
American Philosophical Society Proceedings, Vol. 58, 1919.

The authors state that it is generally considered that the muscular activity of the average woman is less than that of the average man. However, housework in some form still remains a not inconsiderable factor in the muscular activity of most women and exact information as to the energy needs for the performance of duties of the household is essential for computing the daily requirements of the average woman. Their experiment to provide this information was done with 200 young women undergraduates from Simmons college as subjects. The number of women tested in each experiment varied from 14 to 25. A respiration chamber was used that was large enough to seat from 30 to 40 persons. The standard value or base line was established with the subject sitting quietly reading and this was estimated to be not far from 10 percent higher than the true basal. The percent of increase over this base line was as follows: for reading aloud, three percent; standing quietly, nine percent; hemming, 13 percent;

singing, 22 percent; dusting, 134 percent; and sweeping, 150 percent. One experiment on walking indicated that when walking at 1.08 miles per hour the energy cost was 62 calories per mile. Many of their observations with slightly faster rates gave values from 40 to 60 calories per mile. The authors feel, however, that too little evidence is available to indicate whether walking at a slow rate of speed is uneconomical. This figure (62 calories) compares with the value commonly quoted from German sources for walking one mile at moderate rate.

Langworthy, C.F. and Barott, H.G., Energy Expenditure in Household Tasks, American Journal of Physiology, Vol. 52, 1920.

The office of Home Economics, United States Department of Agriculture investigated various factors affecting men and women in the expenditure of energy. This article presents the results of some of those studies of energy requirements for the performance of several household tasks. The respiration calorimeter was used to measure energy and one 22 year old woman was the subject. Measurements of energy expended while resting, sewing, dressing an infant (model), sweeping a floor, washing a floor, washing and ironing towels, and dishwashing were measured. The dishwashing was done at three heights and the corresponding variation of energy expenditures were noted. A variation of 15 percent in height of table caused an energy expenditure of from 20 to 40 percent increase, the low table requiring a higher percent of energy from its user. The observed increase of heat elimination well illustrates the importance of choosing equipment to

"fit" the worker. Of the 53 tasks performed, light tasks such as sewing, crocheting and knitting required an average of nine calories per hour more than sitting. Harder work such as sweeping and washing towels by hand increased energy expenditure 40 to 50 calories per hour over sitting.

Langworthy, C.F. and Barott, H.G., Energy Expenditure in Sewing, American Journal of Physiology, Vol. 59, 1921.

For a number of years the office of Home Economics, United States Department of Agriculture included the use of the respiration calorimeter for investigations of energy required in the performance of household tasks. This article reported the results of a special study of hand sewing and machine sewing. This series consisted of 43 experiments made with one subject. The subject was a woman 28 years old. Little variation was found in the energy required for hand hemming of fine handkerchiefs, cotton sheets and 8-inch cotton duck. The amount of energy used was from 5.5 to 5.8 and 4.3 calories per hour was the surprisingly low figure for hemming army blankets. When the sewing machine was used it took six times as much energy per hour as doing the same work by hand but the energy per meter of sewing was hardly one-half as great. Sewing on a motor driven machine required about one-fifth the amount of energy as compared with the energy used with a foot driven machine. The tests showed that the size and weight of the material sewed had little effect on the energy used. In respect to the accomplishment and economy of energy, the motor driven machine appears several times more economical than the foot power machine.

Benedict, Francis and Parmenter, Hazeltene Stedman, The Energy Metabolism of Women While Ascending or Descending Stairs, The American Journal of Physiology, Vol. 84, 1928.

The authors felt that knowledge of energy requirements for ascending and descending stairs had a practical value for the use of physicians and the physiologist. To obtain this knowledge the authors used a respiration apparatus that could, in a large part, be carried by the operator rather than by the subject. The experiment was conducted at Mount Holyoke College, South Hadley, Massachusetts. Twelve young college women were the subjects. The amount of energy consumed was measured. Oxygen consumption during horizontal walking and during ascent and descent of stairs was measured. For practical purposes the findings of this study can be expressed as follows: in walking up one flight of steps (15 steps each 20 cm. high) the average person expends the same amount of energy as he does in walking fifteen times the distance on the level. The average person uses five times as much energy to descend stairs as to walk on the level the same distance. In measuring horizontal walking it was found that walking at 34 meters per minute used 0.64 calories per horizontal kilometer, walking at 65 meters used 0.52 calories and walking at 89 meters per minute used 0.67 calories. In these figures the calories used for standing have been deducted. These values indicate that the optimum rate of walking is about 65 meters per minute and sauntering is uneconomical of energy use.

Swartz, VeNona, Human Costs of Operating a Vacuum Cleaner at Different Speeds, Journal of Home Economics, June 1929.

The purpose of this study was to increase the meager

knowledge in the field of human energy costs of household tasks and to find specifically the speed of operation for the Hoover vacuum cleaner most efficient from the point of view of expenditure of human energy. Indirect calorimetry was employed and a Douglas bag was used to determine energy cost. The study included intensive study on one subject and a confirmatory series on nine other subjects. Results show that total energy cost increases with increased speed when operating a vacuum cleaner. A speed of not more than one foot per second was judged to be the most economical for operation of a cleaner of this type.

The review of literature pertaining to energy costs indicated that 1919 was the earliest that any study has been made on energy expenditure in household tasks. Studies reviewed classified housework as light, moderate and strenuous. In light work were grouped reading, singing and sewing. These increased metabolism over sitting about 24 calories per hour. Strenuous work included washing, scrubbing and sweeping. These increased energy expenditure about 50 calories per hour. Besides the economy of energy at slow speed, the author concludes with the information that previous research in the Hoover laboratories showed the cleaning efficiency was as good or better at the slow speed of operation.

Page, Richard M., Measuring Human Energy Costs in Industry: A General Guide to the Literature, Genetic Psychology Monographs, Vol. XI, Clark University Press, Worcester, Massachusetts, 1932.

This work represents a careful and thorough review of the literature pertaining to measuring energy costs. It is

directed toward enlarging one's information on effects of muscular activity, recovery from such activity, and fatigue factors on energy consumption of individuals. Because there was no general manual in English available that gave information on methods of measuring energy costs, apparatus used or results in the field of measuring energy costs of human work, this work was prepared to provide such information to industrial engineers and industrial psychologists. This monograph is only a guide to the literature in this field but it includes information on equipment and apparatus used in measuring energy and covers application and results. Research in energy costs for body actions and household tasks are included. Studies in fatigue are also included. The accompanying bibliography is complete and points to the fact that research in this area is not extensive.

Swartz, VeNona W., The Human Energy Cost of Certain Household Tasks, Agricultural Experiment Station Bulletin No. 282, State College of Washington, Pullman, June 1933.

The purpose of this study was to extend the work previously done by other research workers in measuring energy costs of housework. Oxygen consumption was measured with a Benedict knapsack apparatus and the results reported in calories per square meter of body area per hour. A variety of household tasks were measured and summarized in a graphic statement. Energy costs were also expressed in percents above energy used when resting. No measurements were made of fatigue arising from the tasks but the author feels that such would probably be roughly proportional to the energy expended. From 2 to 7 women subjects were used in each test. Laundry tasks consumed the most energy. Hanging clothes

from the floor used 184 percent above resting, rinsing clothes 161 percent, hanging clothes from a table 118 percent, wringing clothes with electrical extractor 125 percent, wringing with an electric wringer 99 percent, ironing standing 79 percent, ironing sitting in a chair 62 percent, ironing using a rotary electric ironer 45 percent, kneading dough at high table 116 percent above resting, and at low table 133 percent. Mixing batter was 50 percent above resting and the table level did not affect the energy used. Peeling potatoes used 45 percent over resting when standing, 43 percent sitting in a chair and 54 percent sitting in an uncomfortable position on a high stool. Tests indicated that weight of the iron used when ironing had little bearing on the energy used. The study showed that there was much variation between persons in the amount of energy they used to perform the same task. In the test for ironing while seated, the surface had to be relatively higher than when standing and the author felt that a lower surface would have further reduced energy consumption.

Morey, Nancy Booker, The Energy Requirement of Farm Women, Journal of Home Economics, January 1936.

The purpose of this study was to secure data on the energy intake of farm women. In doing this all available data from known sources were collected that gave energy costs for household tasks. The figures given all allow for the energy required for maintenance and effect of food in addition to the energy required for the activity itself. When the original study from which the author uses such findings was stated in different terms, the data were

recalculated. Material from 10 different energy cost studies was assembled and was expressed in energy expenditure of average calories per kilogram per hour for different household tasks. This summary of energy costs indicates that body motions and activities and household tasks vary widely in energy costs. The author used the known energy costs of different single operations and then from these estimated the energy costs of larger operations and activities. By this method, she found that clearing away and washing dishes used 2.95 calories per kilogram per hour, washing clothes 2.94, care of children 2.93, preparing meals 2.48 and care of house 2.46 calories per kilogram per hour. The activity reported that was the most costly in energy use was sweeping a rug with a broom. This used 4.38 calories per kilogram per hour.

Hoover, James Edward, Analysis of Variations of Human Energy Consumption with Length of Movement Under Equal Pace, Master's Thesis, Purdue University, Lafayette, 1950.

The introduction of this thesis gives the viewpoint that it has been known that different tasks require different amounts of human energy and that energy expenditure could be measured by the oxygen consumption of the person doing the task. This is not enough. We need to determine the differences in energy expenditures for differences of performance on the same job. It is known that a person may increase his rate of speed but still this does not show what relation this rate of speed has to the energy expenditure. The main purpose of this study was to prove valid or invalid the supposition that pace of work is related to the amount of energy expended in doing the work and that energy expenditure will increase

proportionately to pace. A reasonable sample pace that had been determined in previous work by Mundel was selected. A full arm movement was selected to measure. Nine male students at Purdue University were selected as operators and nine tests were made on each operator. The Sandborn Metabolator was used to measure oxygen consumption. The results of the study prove valid the supposition that pace is directly related to the amount of human energy expenditure in doing work, with the increase of rate increasing the amount of energy used. Pace is defined as the observed rate of acceleration. This finding of the author holds forth many possibilities for comparing the activity of two or more people doing the same job and aids in establishing the rate of a person for doing a job.

Bratton, Esther Crew, Oxygen Consumed in Household Tasks,
Agricultural Experiment Station Bulletin No. 873, Cornell
University, Ithaca, 1951.

The purpose of the study reported was to determine the energy expenditure in activities common to the performance of household tasks. Eight activities were selected and nine young women (homemakers) were selected as subjects. Energy was measured in terms of the amount of oxygen consumed. Some significant findings were that in comparing reaching at a level of 46 inches to reaching at a level of 56 inches, the latter required twice as much energy. Reaching 72 inches required four times as much energy as reaching 46 inches and reaching 3 inches from the floor required nineteen times as much energy as reaching at the 46 inch height. The "knee bend" position of stooping to the floor consumed 547 cc. of oxygen as compared with 312 cc. for the trunk bend action. The energy cost of each tested activity was comparatively small but

because these activities are the type commonly used in work centers and with appliances and commonly used for several hours each day, they deserve consideration as a possible way of saving energy. The importance of energy cost does not imply that the use of energy is detrimental to the body. Energy costs must be weighed against other costs, as in the trunk bend, that compresses internal organs and distorts back alignment. In comparison, the "knee bend" uses more energy but this action is still recommended by specialists because it involves the large strong muscles of legs and thighs and permits the trunk to be held straight. Women do not realize how much they lift when they pick up a small object. It is the lifting of a large portion of the body that makes the effort. The information contained in this study has many practical implications for homemakers in their use of equipment of traditional design.

SECTION III

POSTURE AND CORRECT BODY MECHANICS IN RELATION TO HOUSEWORK

Body posture and effective body actions are closely related. In teaching work simplification a challenge lies in this area. It is very easy for too much emphasis to be placed on such things as "model kitchens", automatic equipment and special tools and gadgets. There is a dramatic appeal in the use of new mechanical appliances and writers, advertisers and manufacturers are constantly keeping them in the foreground. The teacher must be aware of the possible harm of such an approach. Planning of kitchen units and the use of new equipment and tools should be considered as to their importance in providing the homemaker with ways of using her body that saves energy and employs good postural practices.

Physiologists, medical doctors and physical education authorities are generally agreed that the first step in effective use of the body is correct body posture.

The first bulletin in this section is distinctive in that the writer found it to be the first comprehensive publication that applied correct posture to household activities. It is the original bulletin used in developing the charts used in the United States Department of Agriculture bulletin, Posture in Housework.

The material condensed in this section is varied in content. Of the nine abstracts, three are reports of research and four are publications that give important facts about posture. One of these is the German bulletin mentioned above. There are, in addition, two articles included that are presented from a "popular" standpoint because they may

stimulate general interest in the importance of good posture.

Villwock, G., Hausarbeit Leicht Gemacht, (Housework Made Light - English translation), Hauswirtschaftlicher Lehrdienst des Reichskuratoriums für Wirtschaftlichkeit, I. Vortrag, 4th Edition, Berlin, NW 70, 50 RM, 1934.

This German publication is a practical presentation to housewives of the fact that it is their duty to use their bodies wisely. Warnings are given as to what not to do in the use of the body when performing various body actions and household tasks. The author warns one to avoid stooping and bending and then contributes this practical application, "To those who find bending very difficult, namely, older women who suffer with rush of blood to the head, it can safely be advised to drop to one knee. When only short work times are involved, one need not fear harm to the knee..... Young women and girls will naturally scarcely be inclined to kneel since it is less difficult for them to bend over quickly once". This bulletin contains 20 sketches or charts that illustrate the body positions such as: lying down, sitting, standing and stooping to the floor. The comparative efforts are given as follows: sitting requires four times the effort of lying down; standing twelve times the effort of lying down; and stooping fifty-five times the effort of lying down. Practices of good posture are applied to care of floors, hanging clothes, thorough cleaning and dusting. Sitting at housework and correct work levels for sitting and standing are stressed as well as safety practices when doing housework.

Knowles, Eleanor Elaine, Relation of Posture to Fatigue in Ironing, Journal of Home Economics, November 1945.

The purpose of this study was to investigate the causes

and effects of fatigue in the performance of household tasks. Ironing was selected because it involved repetitive processes and therefore seemed to lend itself more favorably to intensive study. Twenty-three homemakers were observed in their homes during one or more ironing periods. Through watching these women poor posture was observed to be as a result of ironing boards that were too low. The metabolic, respiratory and heart rates, her postural balance and force she exerted on the ironing board were measured for each of the women. Motion picture analysis was also used to show the effects of poor ironing board heights on posture. All tests showed a marked rate of increase in responses when they ironed at a board too low as compared with a board of the preferred height. The author consulted physiologists to establish the fact that work done in the home is not sufficiently strenuous to bring out changes in the character of products of metabolism. Ironing is classified as light moderate work but this study showed that certain body processes were noticeably higher when they worked at heights that caused poor posture. This study shows that a desirable height for the ironing board cannot be established by any rule of thumb method. More fundamental than body height are such factors as fullness of upper arm and of vision. Efficient performance of any major household task makes necessary equipment which is either adjustable or with wide variety of measurements and some understanding on the part of the homemaker of the importance of the need of equipment suited to her body proportions.

McCordic, Margaret P. and Denniston, Helen, Make Work Easier, Extension Service Circular No. 365, University of Wisconsin, Madison, November 1945.

Efficiency engineers and factory workers have studied motions and improved jobs. In the same way women can study their motions and improve their methods, avoid strain and develop and keep good carriage. Some of the basic principles about movement and posture that apply to all work and that are listed in this bulletin are: work while standing is best done with feet apart for a broad base and easy shift of weight to allow for a wide range of movement; point the toes straight ahead to prevent strain on the ankle and instep; pull the abdomen up and hips down to hold the pelvis steady as a base for the spine and lift the breast bone to allow heart and lungs plenty of room. A circular arrangement of equipment and supplies makes them easier to reach when reaching is necessary. Energy and time can be saved by taking one long step instead of several shuffling steps. Fifty photographs apply and illustrate these stated principles to a variety of household activities and farm and garden activities as well. Such body actions as standing, climbing stairs, sitting in a chair, bending, pushing, lifting and relaxing are shown.

Detailed description of the best way to relax suggests that one should relax in a quiet room with a dim light, all clothing should be loose, anxieties must be forgotten and pleasant thoughts deliberately chosen. Learn to relax in a back-lying position. Draw the muscles of the abdomen so that they feel hard to the fingers, then let them soften. Repeat this to achieve a feeling of relaxation. This ability to relax can be practiced until one is able to keep parts of the body relaxed while other parts work.

Kain, Ida Jean, Sitting Pretty on the Job, Kelvinator Kitchen, Detroit, February 1949.

The author, a newspaper columnist, approaches the problem of improving posture in housework. The only way to lessen fatigue is to apply scientific principles of body mechanics not only to housework but also to all everyday movements. Housework can be turned into good exercise with the right body mechanics. In applying correct body mechanics, the strain of a task is distributed over several sets of muscles. Correct bending saves your back. Stand and sit as "tall" as possible without strain and that points to the importance of correct working surface heights. Sitting takes far less energy than standing. Scrubbing floors is good exercise but takes a considerable amount of energy so the busy housewife had best save her strength. Housework done in perfect posture affords exercise and saves the figure but as prolonging housework to streamline the figure, that is a roundabout way to clean the house or fix the figure.

Posture in Housework, Extension Service Bulletin AIS No. 83, U. S. Department of Agriculture, May 1949.

This publication uses material assembled from a variety of sources. It includes tables and diagrams to show the energy expenditure per hour under different conditions of muscular activity. Energy used is stated in terms of calories per hour for each pound of body weight. The energy used for each form of activity is expressed in terms of percent over the energy used in lying still. Sitting requires 30 percent more energy than lying down. Standing requires 38 percent more. Walking at 3.75 miles per hour gives an increase of 290 percent. Correct body use and posture are emphasized by the use of

fourteen drawings that show the right and wrong posture of activities performed in the home. Two drawings show maximum and "easy" reach and one chart illustrates the recommended practice of resting 10 minutes out of every hour. The posture charts are based on research findings.

Grady, Ethyl Rathbun, Illustrative Material for Correct Working Arrangements and Good Postural Practices in Homemaking Tasks, Master's Thesis, Kansas State College of Agriculture and Applied Science, Manhattan, 1950.

The author found as a home economics extension worker that homemakers seemed unaware that fatigue and minor ailments often result from poor postural practices and frequently are induced by incorrect working arrangements. Adequate illustrative material was not available to develop this subject with rural homemakers who were or will be building or remodeling their kitchens. This study was aimed to fill this need. Research literature was reviewed to find women's preference in heights of working areas and for working arrangements. Energy and fatigue reactions were also obtained. These data were checked against findings obtained from 135 young women enrolled in the "House" course at Kansas State College. Literature was reviewed and then conferences were held with physical education faculty from Kansas State College and Columbia University School of Nursing, New York. These conferences were held to assure accurate interpretation of correct postural practices and correct body mechanics. Thirty-eight plates, 21 of which are photographs, are provided. Five plates illustrate the correct working heights for various household tasks. The other photographs illustrate correct posture, working levels, comfortable reaches, points to consider in cupboard storage and arrangement and correct

body alignment for stooping, lifting, pushing and relaxing. The author summarizes that home economists and physical education specialists have demonstrated that there is a relationship between correct working arrangements and correct body mechanics and both contribute to lessening fatigue in homemaking tasks. Personal experiments with various arrangements are the only successful guides to correct choices of working arrangements. The author found that the preferences of the Kansas State College women were similar to those of a previous Oregon-Washington study in preferences for working arrangements. Incorrect postures and incorrect body mechanics are factors in producing strain and tension, resulting in fatigue.

Seidelin, Gerda, M.D., Pathology and Hygiene of Housework, A Symposium, Part I, Journal of the American Medical Women's Association, Vol. 6, January 1951.

The author makes this report from material received in answer to questionnaires, original surveys and articles. The questionnaires were concerned with the diseases common to domestic workers and with means of prevention. Thirteen countries contributed answers. The answers were submitted by doctors of medicine. The answers indicate a definite relation of disease in women to too much standing, walking and inadequate kitchen structure, with work being done at work levels of incorrect height. Psychological trouble was felt to be caused by a feeling of incompetence, hence a need for teaching improved methods of doing housework. Unnecessary work also gives cause to frustration and dissatisfaction and this leads to feelings of tension and fatiguability. Several of the doctors stressed the importance of sitting when doing

housework. Dr. Seidelin lives in Denmark.

Muse, Marianne, Seating Housewives at Their Ironing,
Experiment Station Bulletin No. 559, University of Vermont
and State Agricultural College, Burlington, February 1951.

This publication reports an investigation conducted with the aim in mind of finding out about the best equipment to use for the seated worker and to study posture, types of motions and classes of muscles for the best results and satisfactions for the seated worker. Twenty-five housewives cooperated in the study. The results of the study showed that all of the women, after they had completed the experiment, would rather sit than stand while ironing. They were more comfortable, expended less effort, became less tired and ironed fully as well as when they stood. The author names ironing as the most tiring task of many housewives and feels that women stand while ironing because they do not realize the importance of conserving their energy and preventing unnecessary fatigue, nor do they understand the extent to which sitting can accomplish this. They do not sit too because their equipment is unsuitable for sitting. It is necessary for the worker to have a suitable chair, ironing board and a well designed light weight iron. The chair and the board should be correctly related to each other in height. This bulletin gives the necessary information needed to select the correct equipment for seating housewives at their ironing.

Bratton, Esther Crew, Let Your Body Work for You, Kelvinator
Kitchen, Detroit, May 1951.

This article deals with the importance of good posture and proper use of the body in housework. Your own body

constitutes your most important item in household equipment. It is well to acquire understanding of how the body functions in work and to develop skill in using the body effectively. Good posture is the basis for effective use of the body in housework. The alignment of the major body weights is good posture from the appearance aspect but it is also good body mechanics. We can make work easier if we keep the main body section, the head, the chest and the pelvic or hip sections, in alignment as much as possible. A second rule for comfortable performance is to hold any object you lift or carry as close to the body as possible. The energy costs of lifting parts of the body are high. An example is that it requires 19 times as much energy to reach three inches from the floor as to reach to a 46 inch height. We can take some of the work out of housework and at the same time make it better exercise if we keep the three body weights in as straight a line as possible. Use the large muscles and bones in preference to the small ones when possible and work rhythmically.

SECTION IV

WITH REFERENCE TO FATIGUE AND THE CARDIAC HOMEMAKER

Fatigue is so much a part of every aspect of work simplification that it may seem that this special classification is not justified. However, it is because of the special importance that fatigue has for the person with heart disease that all the understanding possible should be obtained. The doctor warns the patient to be alert to signals of fatigue. She is given definite activity restrictions. In turn these restrictions can easily result in emotional tensions, feelings of futility and even fear. With an understanding of the many aspects of fatigue one can better understand the problems of these cardiac homemakers.

The most usual viewpoint concerning fatigue has been the one commonly considered in industry; that is, that fatigue results from physical effort. Two of the group of the five abstracts in this section touch on this prevailing concept. The other three reports deal with the newer concept, that fatigue is an expression of disorganization of the whole person. Two of these articles report on different aspects of one study conducted at Michigan State College where this hypothesis was tested in its relation to housework.

Ryan, Thomas Arthur, Work and Effort, The Ronald Press Company, New York, 1947.

This book provides a systematic survey of psychological investigations concerned with productivity of men and women at work. Among the problems treated are: training and learning, control of accidents, establishment of pay levels for various jobs and the design of efficient methods of work.

Motivation of the worker is considered in its relation to problems of efficiency. The book presents conclusions drawn from research in various fields and also attempts to acquaint the reader with methods of research that lead to the findings set forth. This publication is written for supervisors, managers of industry, teachers and workers who have interest in the productivity of man. In the chapter on measuring the cost of work, the author concludes that as for measuring fatigue as an element in the cost of muscular work, decrement of performance in highly motivated workers is still the only useful indicator. This has its drawbacks when applied to a practical setting because of the variation of motivation. But research has not yet provided any adequate bodily test for determining the degree of fatigue resulting from a given task. He uses the term sedentary work instead of the common term mental and in his chapter "Fatigue in Sedentary Work" he stresses the need for research and the need for new procedures for testing fatigue.

Bartley, S. Howard and Chute, Eloise, Fatigue and Impairment in Man, McGraw-Hill Book Company, New York, 1947.

This work grew out of the recognition of the need for a consistent and comprehensive view of fatigue. Fatigue and impairment are not identical. Impairment refers to specific tissue conditions of the individual. It is a physiological change in the individual which reduces his ability to function organically. Fatigue is an experience of the whole person. Fatigue must be considered in terms of the whole person and does not depend crucially on energy expenditure. Neither fatigue nor impairment can be measured in terms of work output.

The critical determination of fatigue is organization. The authors discuss personal factors in the work situation such as visual performance, sleep, conflict, frustration and others, to point out that fatigue is an over-all state of the person. The book reviews the kind of formal studies that have already been done under the name of fatigue, discusses general methods and procedures for finding the things that we need to know about fatigue. In the past no clear cut distinction has been made between fatigue and impairment. To study fatigue we should utilize common experience as a starting point.

Ries, Estelle H., The Conquest of Fatigue, Hygeia,
February 1950.

Fortunately the most trifling readjustments can often eliminate much fatigue from daily life. New equipment does not mean it is right for you. Such things as feet not touching the floor when sitting, having a work table the wrong height for comfort, poor light, stale air, noise, unsuitable clothing and poor organization of materials and equipment are causes of fatigue for the housewife. Repetition of motion, overeating, undereating and overindulgence in stimulants and narcotics are other causes of fatigue. Another factor is too much haste. In physical fatigue a by-product lactic acid cannot be removed as fast as it is produced. This brings about a toxic condition known as fatigue.

Rest periods are valuable during the day as they give the body a chance to remove these poisons. Frequent rest even before you feel tired will enable you to accomplish far more. Physical fatigue is healthy and is seldom dangerous but

emotional fatigue is generally regarded as insidious. We do not generally distinguish from psychologic and physical fatigue. An important part of one's treatment for fatigue is frankly psychological. Rest will cure physical fatigue but in psychologic mind cure is needed. We must consider our individual ups and downs in energy and plan work accordingly. The author feels that the methods of conquering fatigue are extremely varied and it is part of wisdom to consider them all.

Gross, Irma H., Fatigue in Relation to House Care, Journal of Home Economics, December 1950.

The author states that one of the objectives of home management has been the avoidance or lessening of fatigue in homemaking activities. The universal assumption has been that it is desirable to cut down energy output because it was accepted that fatigue accumulated in the body perhaps quantitatively in relation to output of energy. Within the last few years a newer interpretation of fatigue has developed, that fatigue is different from body impairment and that it is an outcome of certain forms of personal disorganization in the same category with anxiety. There is also confusion in popular thinking between local muscle discomfort and either fatigue or impairment. A research study was developed at Michigan State College in 1949 with 20 homemakers in the community. The specific purpose of this study was to investigate the development of fatigue during a two-hour period of related house care activities centered around weekly cleaning. Because of the small number of cases, little attempt was made to present statistical data but the subjective findings point to certain indications. Researchers

found only a few indications of relationships between cleaning procedures and the state of fatigue. There were more indications of lack of routine and indecision in the group that felt great fatigue. The study points to the conclusion that orderly procedure with relatively few delays is linked with lack of fatigue. A similarity of the fatigue pattern in individuals indicates that each person may establish habits of fatigue in relation to specific jobs. The patterns showed no consistent development of fatigue from beginning to the end of the work period nor could the reduction in fatigue after short rest periods be explained on the basis of energy renewal. This study that gives the fatigue patterns of 20 cases links them with a few variables and then obtains the worker's expressions of feeling of fatigue, supports the view that relatively few household tasks expend enough energy to cause a high degree of fatigue and there must be some other explanation of tiredness.

Gross, Irma H. and Bartley, S. Howard, Fatigue and House Care, Journal of Applied Psychology, Vol. 35, No. 3, June 1951.

This article is a report of a study conducted at Michigan State College with a group of 20 homemakers. The aim of the study was to determine the occurrence of fatigue when doing weekly cleaning. The study was based on suppositions supporting recent conclusions of certain students of fatigue that fatigue is an expression of certain forms of disorganization with reference to activity rather than a result of physical effort. This interpretation implies a personalistic viewpoint. The results of the study showed that there was a positive relation between fatigue and other

factors that were suggested by finding the subjects' attitudes. Those who became bewildered by clutter, those who found making decisions difficult regarding what to do next and those who had a general distaste for the job were the ones who became tired. The authors feel that it is practical to study fatigue from a nonenergetic viewpoint.

SECTION V

VISION AND ITS BEARING ON THE PROBLEMS OF THE
CARDIAC HOMEMAKER

Household equipment texts, educational divisions of public utility companies, manufacturing companies and college extension services have stressed the importance of adequate lighting as it relates to the well-being of the individual. As a result of these educational programs and the stress these programs have placed on the relation of the act of seeing to fatigue and the use of energy, questions are often asked about this. Few reports of research were found and, of those found, only three seemed to fit into this type of a study. In a college text book, Household Equipment by Louise Peet and Lenore Sater Thye, this quotation by Dr. I.B. Metzger, former president of the Pennsylvania State Board of Medical Education, is given: "Twenty-five percent of our energy is consumed in seeing with normal eyesight and proper illumination". An effort was made to find the research on which this statement was based but no such research that measured energy used in seeing could be found. Many references to the relation of fatigue and seeing were found and there seems to be little doubt that quantity and quality of light have a direct bearing on fatigue. For this reason the importance of good or adequate light should be the concern of those working with cardiac homemakers.

The first article in this section is given in full as it is an unpublished statement by Dr. S. Howard Bartley, an authority on the psychological aspects of vision. Two other articles are included that are typical of the type of

literature being made available by commercial research organizations as a part of their educational lighting programs.

Bartley, S. Howard, Vision and Fatigue, Unpublished Statement, Professor, Psychology, East Lansing, Michigan, February 1952.

All task activity leads eventually to results which we wish to avoid. Tensions develop and interfere with the most efficient and most comfortable performance. Activity is more surely to bring about these results if prolonged, because effects of disorganization of performance are cumulative. The same total of activity of a given sort will lead to less of the undesirable if broken into short periods than if continued in one stretch. Rest or change of task is thus primarily for the purpose of the reduction of tension and for the dispelling of the disharmony. The change, whether it be rest or the shift to another form of activity, thus reverses certain processes and gets rid of more or less disorganization. Breaking task activity up into short periods provides for the body processes that are working toward tension and disharmony to become reversed before proceeding very far.

The activity of restricted mechanisms within the body, such as that of the visual apparatus, does not remain well localized, particularly in prolonged tasks. It begins by involving the strictly local mechanisms but gradually comes to include others. The muscles of face, neck, back, etc. eventually become involved as is evidenced in the marked tensions that are set up in these areas. These "secondary involvements" are not only useless in accomplishing the task at hand but definitely contribute to the disorganization we

call fatigue.

Whatever involves the uncomfortable use of skeletal musculature includes, to some extent, the autonomic nervous system and circulation. This involvement is often of a kind that is disadvantageous to individuals for whom it is necessary to keep circulatory function at an even keel and for whom the minimization of effort is imperative.

Seeing, as represented in the mere activity of the visual apparatus; that is, the eyes, and the neural pathways to the brain, involves the expenditure of little energy. The use of the eyes leads one into so much else that is energy consuming that often times advice is given regarding vision as a strenuous activity. It seems simpler and more effective to advise regarding the limited use of the eyes in certain kinds of tasks than to say "don't" to the unfavorable behavior that is set up in the visual performance. For purposes of clarity, however, it behooves the sophisticated person to distinguish between vision itself and all that becomes initiated and guided and maintained by sight.

Emotional reactions are often part of visual observation. In this way, activity of the autonomic nervous system is altered or heightened, and with this goes changes in circulatory activity. Blood pressure elevation and vasoconstriction are common. When these results are to be avoided, it is obvious that visual tasks or situations inducing them should be avoided.

Luckiesh, Mathew, Important Concepts Underlying Lighting for Critical Seeing, Lighting Research Laboratory, General Electric Company, Cleveland, 1948.

The material published in this leaflet was presented in a paper to the conference of the Illumination Engineering Society, Boston, Massachusetts, September 1948. The aim of the author in this paper was to isolate and clarify certain concepts upon which adequate lighting practices must be founded. Light and vision are tools for the performance of seeing. Vision deals only secondarily with light, strictly it is confined to the visual sense which can be considered as a tool just as light is a tool. It can be sharpened with eye-glasses if necessary. Eyesight specialists care for the eyes and determine visual efficiency just as a tool-maker sharpens and repairs his tools. However, people with normal vision when performing many tasks under prevailing levels of illumination have subnormal vision. This type of subnormal vision is just as real as the kind treated by the eyesight specialist. Because of this fact in countless tasks light and lighting can contribute much by increasing the brightness-level of the task which in turn elevates the visibility-level. Putting this in terms of the concept of industry, good lighting eliminates useless work, even if it is less obvious to measure as it is represented in terms of friction and internal loss. Visibility-level can readily be measured and light can then be provided to raise the visual object or task to a reasonable visibility-level. As knowledge progresses, measurements of visibility-level will probably be correlated more and more with the degree of ease of seeing. Lighting specialists have been greatly enriched by

advances in efficiency of light-production, efficiency of light control and by a variety of new light-sources. If they will apply these tools with adequate comprehension of the basic concepts and utilization of knowledge already available, they have great opportunity to promote human efficiency, comfort, welfare and happiness.

Luckiesh, M. and Moss, Frank K., The Effect of Visual Effort Upon the Heart-Rate, Journal of General Psychology, Vol. XIII, 1935.

Since the heart responds to numerous physiological and psychological stimuli, it is possible that the expenditure of human energy in critical seeing may be revealed or indicated by changes in the heart rate. The research reported in this publication involved an investigation of this phase of physiology by means of direct quantitative measurements of heart-rate. The specific objectives of the research were to determine the relationships, if any, between the heart-rate and (1) the duration of visual effort and (2) the intensity of illumination under which the task was performed. Although respiration or basal metabolism may be considered more directly interpretable, the simplicity of heart-rate favors the use of this criterion. Reading was selected as a task because of its advantage as a universal and uniform problem. The reading matter chosen was The Outline of History by Wells. Seven male students, varying in age from 25 to 35 years, were the subjects. Each subject was instructed to read at his normal rate, begin at the first of the book and progress steadily through it. During the test period the reader was alone in the room separate from any recording apparatus. Physically, the conditions under which the reading

was done were as comfortable as possible. All subjects were in good health and possessed normal vision. Each subject completed a series of twenty 1-hour tests. The tests were conducted at intensities of illumination of 1 and 100 footcandles respectively. The heart-beat was recorded by means of a cardiometer adjusted to operate only upon the R phase of the pulse-curve. The important facts revealed by these data were (1) that the heart-rate progressively decreased as the duration of the visual task increased and (2) that this decrement in heart-rate was much greater under 1 footcandle than it was under 100 footcandles. Three charts showed graphically these results. Interpretations and explanations supplement this statistical material. The fact that a relatively large depression in heart-rate was observed under the lower intensity of illumination, but not under the higher, can be interpreted as indicating that the sensory processes were abnormally taxed in the former case. Emphasis is placed on the sensory rather than the mental phase. This is done as it is reasonable to assume that the latter is not a variable in this study. In general, the purpose of this study was to extend knowledge of the physiological effects of critical seeing and to aid in determining the optimum conditions for seeing but the results may also have significance when interpreted for anomalous pathological cases.

SECTION VI

RESEARCH STUDIES OF SPECIFIC HOUSEHOLD ACTIVITIES

Homemaking is made up of a highly varied combination of activities that are usually carried out in an inter-related pattern of procedure. Hence, it is difficult to find single household activities that are concise enough in their limits to be studied as single units. For this reason few such studies have been done. Those that lend themselves well to this type of consideration are dishwashing, bed-making and ironing. The type of research study reported in this section should point out the fact to the teacher that there is no "one best way" to perform any household task. Class members should be trained to receive suggestions and recommended techniques with this in mind and should be encouraged to be constantly alert, looking for improved methods that will work best for them with their particular set of conditions. The teacher who uses this approach will find that a valuable part of the class program will be sharing by the class members of the improved work methods that they have been able to develop.

The four research studies reported in this section show a variety of methods of job analysis that can be used in developing improved techniques for housekeeping tasks. Three of these studies deal with dishwashing and the other study reports on two improved methods of bedmaking.

Heiner, Mary Koll and Vedder, N. Maude, Studies in Dishwashing Methods: An Attempt to Apply Methods of Job Analysis to a Household Process, Journal of Home Economics, Vol. 22, 1930.

The authors apply the methods of industrial job

analysis to dishwashing. They first attempted by interviewing one hundred homemakers to set up a standard for the usual method. Then to make an analysis they used stopwatch timing under carefully controlled conditions. Six units of operation were observed and from these observations 1954 motions requiring 38 minutes and eight seconds were established as an average for handwashing. By working out an improved method, without changing equipment, motions were reduced to 1008 motions and 22 minutes, 38 seconds of time. By washing in a stationary dishwashing machine once a day, motions were reduced to 1015 with 22 minutes, 31 seconds time. Some of the improvements used to reduce the motions and time for handwashing were: washing dishes once a day instead of three times, allowing dishes to air dry instead of drying by wiping with a towel, and adoption of "convenient storage". In the comparison of handwashing and machine washing, the authors feel that the results they obtained do not give a complete answer. Measurements of fatigue and psychological reactions should be included. A fundamental requirement in arriving at methods of least waste of energy and time is willingness to break with traditional methods of work.

Nelson, Gladys, A Study of Dishwashing Methods from Right to Left and Left to Right by Means of Micromotion Analysis, Master's Thesis, State College of Washington, Pullman, 1947.

This study was set up to determine whether the direction of working had significant effect on the efficiency of dishwashing measured in terms of time and motions. Techniques of dishwashing were studied to determine the acceptable

methods to use for this study. Process charts, micromotion and simo-charts were used. These results plus findings of past research were considered by a committee of specialists and the most acceptable methods were selected. Some of the selected techniques were: when washing glasses allow the left hand to rotate the glass while the right hand manipulates the dishcloth; five pieces of silver were the best number of pieces to manipulate and yet wash thoroughly at one time; plates were turned over by wrist action to wash underside without changing position of fingers; a smooth round swipe was the movement accepted for washing the plates; and a large mesh dishcloth was selected for this method instead of a mop. Immersion in water of 170 degrees fahrenheit for 2 minutes was selected for even drying and an effective measure of sterilization. Spray rinse was eliminated because of resulting streaks. Silver and glasses were washed, rinsed and dried before other dishes to alleviate overcrowding the drainer. Silver and glasses were dried by a towel; all other dishes were air dried. Final recommendations are: glasses and silver should be placed in water at same time, using left hand for glasses, right hand for silver; establish a definite pattern of routine for washing and drying silver and glasses and washing china, then practice this until it becomes a habit; use both hands whenever possible. Dishwashing saves more time and motion when dishes are washed from right to left so sink units should be planned with this in mind. Sinks combining a shallow and a deep tray would be desirable as dishes are rinsed more efficiently in a deep rinse. The best method to rinse is to place dishes

in a drainer and dip the drainer in the hot water, removing it with the dishes remaining in the drainer. From the results of this study an improved method of dishwashing should be developed.

Goble, Eva Lenora, Work Simplification in Dishwashing, Master's Thesis, Purdue University, Lafayette, June 1947.

The purpose of this study was to determine methods most commonly used in dishwashing and to find ways of improving these methods. From a survey of 278 women, five most commonly used methods were selected. Films were made of these methods and micromotion analysis and time studies used to study these methods. From these, two new methods were evolved, one for a sinkless kitchen and one for a sink equipped kitchen. All motions that had shown themselves economical in any of the methods observed were incorporated into these new methods. These new methods were observed and analyzed. Principles of motion economy that were developed for dishwashing were: wash dishes at level of water to eliminate carrying water on cloth to the dish; wash dishes with a circular movement; keep dishcloth in the right hand except when reaching for soiled dishes; and preposition the next item to be washed by hand, holding the cloth while the other hand is returning from depositing the last dish washed. The author concludes that actual handling of dishes by the sink method is not superior to the two-pan method used in a sinkless kitchen but time is saved by the sink method (23 percent) in the collecting and putting away equipment and in getting the water. The fewer pieces of dishwashing equipment used in the sink, the less time is used. The design

of the sink, the depth of the basin and the height of the cabinet in relation to the worker affect the motions used. Bacteriological examination showed that a hot pour-over rinse of 192 degrees Fahrenheit yielded dishes within the United States Health standard four times out of four. When dishes were rinsed under the faucet with water 120 to 122 degrees Fahrenheit, the dishes met the above mentioned standard one time out of four. There was no germicidal difference found between dishes washed with soap and those washed with a wetting agent. Some further conclusions quoted from previous studies are: dishes washed once a day and air dried save 30 percent of motions, 19 percent of the time (Heiner and Veddar); one worker is most efficient (Cushman); with limited space it is a little quicker to use an immersion rinse (Fitzsimmons).

Muse, Marianne, Saving Time and Steps in Bedmaking, Experiment Station Bulletin No. 551, University of Vermont and State Agricultural College, Burlington, March 1949.

In this study the process chart, time measurements and measurements of distances walked were used to find an improved method of making a bed that will require the minimum of moves, operations, steps and time. Three subjects, who were housewives, cooperated in the study. Six methods of bedmaking were compared. Each of two housewives made the bed in their usual way and these were called method I and II. Method III, IV, V and VI were the new methods tried. Methods IV and VI were acceptable. The three subjects did not agree on the same method they would rather use. Method IV required only one trip around the bed whereas method VI required two trips, but took less time, and the

total elements in the process of method VI were less. In method IV all the bedding was placed in position on the bed and each corner was completely made before proceeding to the next. In method VI the bottom sheet was placed in position first and then the rest of the process was the same as for method IV. The time was about the same but the steps were fewer when two made the bed. There were more total elements with two working but the value and pleasure of members of a family working together must be considered. The sheets were folded lengthwise and then in quarters lengthwise as they came from the laundry and were used in this form in all methods. The author feels that there is no best way to make a bed but that a person should try several methods and then select the one best suited to her conditions. This report shows ways of saving time and steps and it also shows how methods of doing any household job can be analyzed and improved.

SECTION VII
KITCHEN PLANNING

In the development of the Cardiac Homemaker's Program, a kitchen unit was planned that demonstrated the application of the principles of work simplification to kitchen planning. This has lead some persons to believe that the Cardiac Homemaker's program is one that is essentially kitchen planning. This is erroneous as kitchen planning is only a part of the program and the kitchen is used as a point of departure for teaching the principles of work simplification. The fact that the homemaker spends more time doing tasks in the kitchen than elsewhere makes this a logical procedure.

Popular magazines, architectural publications and college bulletins provide a wealth of material pertaining to kitchen problems. In this connection kitchen storage has been given special stress. In the work simplification section of this report, Section I, the bulletin Easier Homemaking by Mundel, is reviewed. This has an excellent section on kitchen plans and arrangements. New types of kitchen equipment create the need for studies such as the one reported in this section. Separate oven and cooking units for ranges suggest the need for studies to determine the best location of such units but the writer could not find any such studies. Three publications are surveyed in this group. One bulletin on kitchen planning is included because it was prepared and published after much research and, as a United States Department of Agriculture bulletin, it is easily obtained. The other two are reports of research done

at Washington State College and show the application of time and motion techniques to the problem of location of basic kitchen equipment.

A Step Saving U Kitchen, Bureau of Human Nutrition and Home Economics, Miscellaneous Publication No. 646, U.S. Department of Agriculture, Revised, April 1949.

This bulletin provides a floor plan, gives a description, photographs and drawings of the "U" step saving kitchen designed by J. Robert Dodge, architect. In most states the working drawings can be obtained from the extension engineer or the county extension agent. The department of Housing and Households, Bureau of Human Nutrition and Home Economics, Beltsville, Maryland, will assist in directing one to a department within the state that handles these working drawings. In the plan offered in the bulletin, the three key pieces of equipment, range, sink and refrigerator, are brought within easy reach of each other. This plan is designed to cut walking, stooping, stretching, and to provide a production line going from right to left. Comfortable working heights, handy storage, adequate light and air are all given consideration. The kitchen is planned with a definite location for a mixing center, a vegetable preparation center, dishwashing center, cooking center, serving center and dining center. The main points essential are listed for each center and special features are described and pictured. The pull-out lapboard in the food preparation center is given special emphasis. This board is planned low enough to allow the worker to sit to work with a regulation height kitchen chair. This allows the worker to sit comfortably with both feet on the floor.

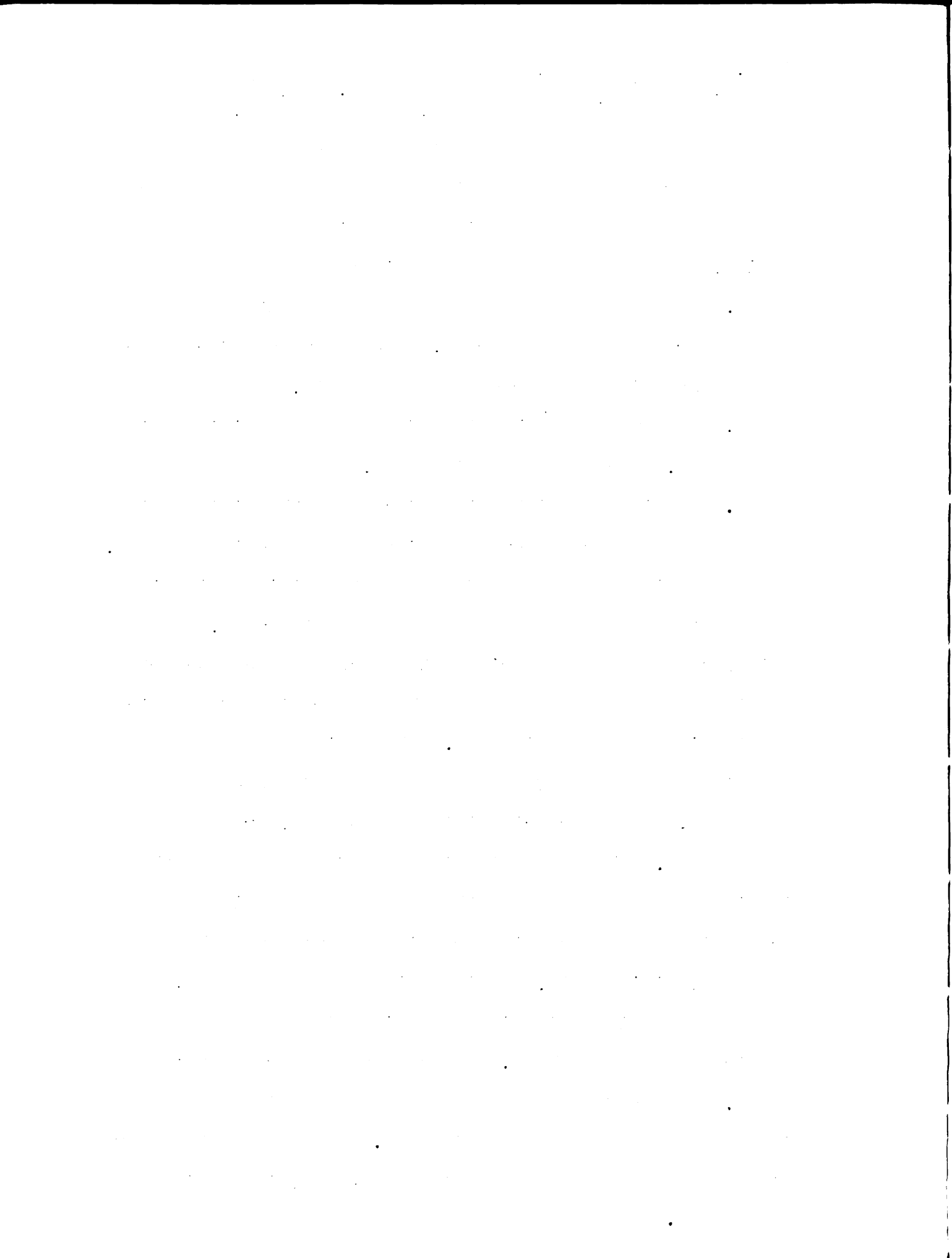
Wiley, Elizabeth Weeks, A Motion Study of Kitchen Arrangements, Experiment Station Bulletin No. 518, The State College of Washington, Pullman, September 1950.

The purpose of this investigation was to compare the following arrangements of equipment as measured by the number of trips and steps required in preparation of the meal - serving, clearing away and dishwashing:

1. Placing of refrigerator adjacent to the food preparation counter vs. placing on an adjacent or opposite wall from the mixing unit.
2. Placing the sink unit adjacent to the mixing unit vs. placing on opposite wall.
3. Placing the sink unit adjacent to the mixing unit with the range on the adjacent or opposite wall vs. having the range adjacent to the mixing unit with the sink on the adjacent or opposite wall.

An improved method was arrived at by use of process-chart techniques and this was used in the preparation of a typical menu in six different kitchens. These kitchens were laid out according to plans perfected at the State College of Washington. They were classified as U-shape, broken U-shape and two-wall. This bulletin gives the floor plans of the six kitchens used and lists the supplies and equipment located in each of the similar units planned in each kitchen; sink unit, mixing unit, cooking unit and refrigerator. The results of the investigation were given in a series of graphic charts and tables. The conclusions drawn are:

A. It was found that there were many trips between the sink and mixing unit in all kitchens. The fewest steps per trip between these units were in the U-type, indicating good arrangement.



B. More trips were made between the range and the sink than between the range and any other unit. Thus the range should be located near the sink.

C. There was some traffic between the sink and the refrigerator when putting away left-over foods and setting the table. However, the relationship was not sufficient to conclude that these should be adjacent.

D. More steps were taken in fewer trips between the sink and table than between the sink and any other unit. In each kitchen most of the trips were taken when setting table and removing dishes to sink for washing. Therefore the sink, with stacking center to the right, should be located close to dining area.

E. There was an average of only six trips between the range and mixing unit. Therefore any arrangement of mixing center and range would seem satisfactory as long as they are only 4 to 6 feet apart.

F. In all kitchens two or three trips were made from mixing center to dining table and these few trips indicate this unit could be farthest from the dining table.

G. There was little relationship between the location of the range and refrigerator. There was a definite relationship between the dining table and range. The trips were taken while serving food. The broken U-type kitchen averaged the least number of steps. A serving counter adjacent to range and between it and dining area saved confusion and steps.

H. There was little traffic between the table and the refrigerator so the latter could be placed farthest from the dining area.

Wood, Anna L., Ribelin, Shirley and Lange, Fay, Location and Counter Area Requirements of a Mechanical Dishwasher, Experiment Station Bulletin No. 526, The State College of Washington, Pullman, June 1951.

The increased demand for the mechanical dishwasher had introduced new problems in kitchen planning. The purpose of this study was to answer the question "should the dishwasher be located to the left or right of the sink and how much counter was required for stacking dishes in loading and unloading?" The study was divided into parts I and II. In part I the front-opening and the top opening dishwasher, representing two general types of construction, were used. Time and motion techniques were employed in studying the location in relation to the sink, using a tape recorder to record the data. Two observers were used and nine college girls were chosen as operators. Process charts were made from the recordings. Findings did not indicate that one location was wholly better than another but location of the dishwasher at the left of the sink has some advantages as this reduced arm motions and steps. There was no appreciable difference in time and body motion. No decided advantage of one type of dishwasher was indicated. However, the front opening required fewer body motions for loading while the top opening required fewer arm motions for this process. Part II had, as its purpose, to determine the length of a standard 24-inch depth work counter required for stacking prior to loading a dishwasher and required for unloading. Plastic forms to represent dishes were cut and used instead of actual dishes and these were placed on the different sized counters in an effort to find the needed counter area. It

was found that when dishes were stored in the vicinity of the dishwasher 18 to 21 inches of counter space were needed when the counter was 24 inches deep. The top of a front opening dishwasher could be used if the operator did not have to reach over the open dishwasher. When dishes were stored in some other area, 33 to 36 inches of space were needed.

SECTION VIII

PUBLICATIONS WITH REFERENCE TO HANDICAPPED AND CARDIAC
HOMEMAKER'S PROBLEMS

In the other sections of this report the research and other publications reported were selected from the field of home economics and other related areas. The selections were made with the idea that they were applicable to the various aspects of the problem of teaching work simplification to homemakers. Besides these there was a variety of publications that were found, touching in one way or another on the subject of the handicapped homemaker or providing some kind of information about the cardiac homemaker's classes. These are grouped together in this section for convenience rather than because they are similar in subject matter.

No publication was found that included an outline or course of study for cardiac homemaker's classes. Brief mimeographed or typed outlines were obtained that had been used for such classes of the St. Louis, Missouri Heart Association, the Washington State Heart Association and those used by the Michigan Heart Association in cooperation with Wayne University and Michigan State College. Reports from the published news bulletins of heart associations and the parent heart association, the American Heart Association, is the authority for the statement of the fact that Michigan is the only state where the Cardiac Homemaker's classes have been carried on through the facilities of a university or college. In Michigan, Wayne University Home Economics Department offers classes to cardiac women in the metropolitan Detroit area and for those in the surrounding

communities. Michigan State College has set up the program as a special project within the School of Home Economics through the Cooperative Extension Service of Michigan State College. These classes are offered as one of the home management projects that are available for the county home demonstration agent to select as part of the county home economics program.

There are seven articles surveyed in this section. Three of these deal with the cardiac homemaker's classes that are a part of the Michigan Heart Association's educational program. Two other articles are aids to teaching cardiac homemaker classes and are available through the American Heart Association. The same person is the author of the other two articles but each deals with a different phase of the problem of the handicapped homemaker.

Heart of the Home, American Heart Association, New York, 1948.

In 1948 a "Heart" kitchen was constructed according to plans worked out by a sub-committee headed by Dr. Lillian Gilbreth. This pamphlet gives the floor plan for this kitchen. All features are listed and shown in a series of photographs. The aim of this publication is to encourage the homemaker to apply the practical suggestions in her own kitchen to help her save time and energy. This kitchen is not designed as a "model" kitchen but as a demonstration kitchen. Other information is included in the publication that deals with body mechanics, mental hygiene, the importance of moderate pace and general rules for persons with physical limitations to follow. The principles of work simplification are given with practical suggestions for their

application to household tasks. Line drawings illustrate the different points covered. A motion study check list is included as an aid to applying work simplification to household tasks. This booklet was designed to help the person find easier ways of doing housework. The easier way is more pleasant and efficient and gives deep satisfaction. The emphasis of applying work simplification in the home and kitchen is put not on expensive gadgets or elaborate remodeling jobs but on applying the principles of work simplification to develop better work methods.

Heart of the Home Program Kit, American Heart Association, New York, 1949.

The purpose of this kit is to provide material that will help heart associations to set up and carry through a community service program. The material is assembled in a convenient loose-leaf folder type of manila envelope. In the loose-leaf section are given steps for the setting up of the program, a fact sheet with a supplement, a list of program material that may be ordered from the national office, with prices and a list of supplementary, inexpensive teaching materials and the place to find them. A bibliography is also included. The front pocket of the kit contains: picture edition of Heart of the Home Bulletin, Heart of the Home film flyer, Posture in Housework bulletin, suggested form letters, report forms, teaching plans of study and a work simplification report. The back pocket of the kit gives script for Heart of the Home slide film, an order form and a list of the State Extension Directors.

Judson, Julia, Home Management Aids for Women with Physical Limitations, Master's Thesis, Ohio State University, Columbus, 1949.

The author selected 50 handicapped women; four were cardiac patients. These women were questioned to find out what jobs in the home they found most difficult and what body motions and actions they considered most difficult. The author then gives suggestions for improved methods that would save effort and reduce unnecessary motions for the handicapped. From the findings of the questioning, it was found that climbing stairs, stooping and reaching were considered most difficult for the heart patients and their greatest need was felt to be a one-floor house and a rearranged kitchen. The conclusion drawn from the study was that there was no positive indication of a definite relationship between a woman's disability and the activities she felt were difficult. Time, motion and energy saving techniques can be applied to specific cases or general conditions. Handicapped persons must understand their limitations, evaluate present practices, weigh family values, make changes they can afford to make in tools and equipment and experiment with new methods and practice them. Rehabilitation programs should recognize the problems of the handicapped homemaker. There is a need for coordination of doctors, social workers, design engineers and architects in making a contribution to the needs of the handicapped homemaker.

Judson, Julia, The Physically Handicapped and Kitchen Operation, Kelvinator Kitchen, Detroit, January 1950.

The wide variation in the extent of disability or

limitation, plus the individual's personal reaction makes each case different but the approach to the problem is similar to that of any home management problem with emphasis on the limitations imposed by the disability. Analyze the situation by asking what tasks or activities can be done safely; what should be avoided; what are the essential needs of the family for health and happiness; where does the family need the homemaker most; what jobs can be eliminated; who else can do them; what methods, equipment or working areas can be altered or adapted; and how much money is available for equipment or construction?

Kitchen operation is the area of homemaking that occupies more time and energy than any other except child care. Size of the kitchen, storage arrangements and working heights should all be given consideration in relation to the patient's disability. The foremost consideration is that the person should be comfortable. For sitting, the low chair is more satisfactory than perching on a high stool. Special care should be given to the relationship between the working surface and the seated worker. There is a need for adequate back support on all chairs and need for foot support when the high chair is used. Weight of cooking pans and mixing bowls should be kept in mind. Tables on wheels are indispensable for the handicapped. Careful planning of work to distribute heavy tasks throughout the week or day, as well as planning of individual tasks, is important. The saving of energy by using of short cuts in kitchen procedure should be tried and practiced. Techniques in manipulation of tools should be developed. The gross arm movements should be used

when possible instead of fine finger motions. The foregoing suggestions only touch the high spots of working with handicapped in kitchen operation. Suggestions for time and energy management need special emphasis for the handicapped.

Bielawski, John G., M.D., The Cardiac Housewife Program of the Michigan Heart Association, The Journal of the Michigan State Medical Society, Vol. 49, December 1950.

As executive director of the section on Occupational Cardiology, Michigan Heart Association, the author reports the development of the cardiac housewife program in Michigan. The cardiac housewife program is designed to be of aid to the physician in the management of his cardiac housewife patients. One of the very important factors in the treatment of ambulatory cardiac patients is teaching them to limit their activities. For the housewife, the physical effort expended can be greatly reduced by application of work simplification methods. Practical courses teaching these work saving methods are now offered as a community service by the Michigan Heart Association. The first classes were offered to cardiac women in the Detroit area and were taught at Wayne University in cooperation with the Home Economics Department. Classes are now being organized for presentation throughout the state in cooperation with the School of Home Economics at Michigan State College.

Sanderson, Frances G., Improving Work Habits of the Cardiac Homemakers, Kelvinator Kitchen, Detroit, June 1951.

This report tells of the cooperative program developed cooperatively between Wayne University and the Michigan Heart Association. The interest in this program developed when Dr. J.C. Bielawski, occupational cardiologist for the

Michigan Heart Association, attended a convention in New York. He became familiar with the "Heart Kitchen" developed for the New York Heart Association under the direction of Dr. Lillian Gilbreth. When Dr. Bielawski returned to Detroit he contacted Mrs. Sanderson, Chairman of the Department of Home Economics, Wayne University, Detroit, and the first step of their plan was worked out. This was a trial study on one cardiac patient. Many visits were made to this patient and results of this study were recorded by photographs and diagrams. A six-month pilot study to investigate habits of the cardiac homemaker were set up and two more patients were obtained to cooperate. The results of this study brought about the establishment of classes for cardiac homemakers. These classes were conducted in the home economics laboratory at Wayne University. These classes were financed by the Michigan Heart Association so were free to the women attending. Each patient attended three class meetings and the class group numbered from 16 to 20. The program of the three classes included: getting acquainted, demonstrations of easier methods of doing some tasks and sharing of experiences by class members. The class members worked in small groups and reported on the progress they had made. The class members have reported that laundry work is one of their most tiring activities. The aim of the class teaching is to provide the patient with the "know how" to take it easy. The goal is to help each cardiac to live a more normal satisfying life by learning new habits of work.

Houts, Marion Tate, Application of Work Simplification Methods to Specific Allowed Activities of the Cardiac Homemaker, Master's Thesis, Wayne University, Detroit, 1951.

This thesis describes the cardiac homemaker's program initiated in Michigan in 1950. The Michigan Heart Association cooperated with the Home Economics Department at Wayne University. The basic principles of work simplification and methods of applying them were selected from literature. A report was made of the pilot study done with three cardiac homemakers. This study included observations of the old methods the homemakers used in doing their work with time recordings, estimated energy consumed and audio-video recordings. Judged subjectively, the new methods used resulted in increasingly better health, reduction of fatigue, improved morale and new allowed activities. Classes for cardiac homemakers followed this pilot study and the class outlines of the subject matter taught and the class procedures were outlined in this report. The author concludes that teaching of work simplification is not only of benefit to the physically handicapped homemaker but to all homemakers. Changes can be effected with minimum cost. No homemaker is aware of the great energy saving possible until she subjects her habits to critical examination. Then she must possess a positive approach to change.

SECTION IX

THE HEART, HEART DISEASES AND TREATMENT

This material is chosen from the current or popular field because it seems only necessary to be informed in a general way on this subject. This area of information is definitely the subject matter for the doctor only to discuss in any way whatsoever with the cardiac patient. The work simplification representative, however, should be informed as to the function of the heart, how it works and should have some basic information concerning the general problems of heart disease. She should know something concerning the various types of heart disease and the prevalence of each as well as the symptoms and general methods of treatment. From this section of reading, the most significant points for the teacher to absorb are the general optimism that is shared by doctors working with heart patients as to the many possibilities for reducing suffering and deaths from heart disease and the viewpoint that limited activity is not only permissible for many persons suffering from heart disease but in some cases even beneficial. This knowledge gives the teacher a positive and confident approach in her teaching. Her problem then becomes how to teach the cardiac homemaker, the best way of using this allowed activity so that it will give the patient the greatest amount of value to herself and to the members of her family.

In this final section there are seven articles surveyed. With the exception of one article that is an explanation of how the heart functions and one other brief quotation from the Science Digest, all the material was made available

the first of these is the fact that the system is not a simple one, but a complex one, in which the various parts are interrelated and interdependent. The second is that the system is not a static one, but a dynamic one, in which the parts are constantly changing and evolving. The third is that the system is not a closed one, but an open one, in which the parts are constantly interacting with the environment. The fourth is that the system is not a linear one, but a non-linear one, in which the parts are constantly interacting with each other in a non-linear fashion. The fifth is that the system is not a deterministic one, but a probabilistic one, in which the parts are constantly interacting with each other in a probabilistic fashion. The sixth is that the system is not a simple one, but a complex one, in which the various parts are interrelated and interdependent. The seventh is that the system is not a static one, but a dynamic one, in which the parts are constantly changing and evolving. The eighth is that the system is not a closed one, but an open one, in which the parts are constantly interacting with the environment. The ninth is that the system is not a linear one, but a non-linear one, in which the parts are constantly interacting with each other in a non-linear fashion. The tenth is that the system is not a deterministic one, but a probabilistic one, in which the parts are constantly interacting with each other in a probabilistic fashion.

through the Michigan Heart Association. For this reason, the writer feels that it expresses the viewpoint commonly shared by those who are best informed about heart disease and its treatment.

Bay, Emmet B., M.D., Some Aspects of the Non-medicinal Management of Heart Disease, The University of Chicago Round Table No. 517, February 15, 1948.

This paper is part of a special supplement on heart disease. The author discusses psychosomatic medicine in relation to the heart patient and the early ambulation or activity of convalescent patients. He states that while it is desirable that patients with serious heart trouble refrain from activity producing serious symptoms, it is increasingly evident that patients with all forms of heart trouble should be active almost to the limits of their capacity. This amount of physical activity should be prescribed by a competent physician on the judicious evaluation of several factors. On the whole it is better to err on the side of optimism rather than pessimism when giving advice about exercise. There is an interrelationship of greater or less importance between the physical and mental activities of patients with heart disease and many patients have been largely disabled by virtue of cardiac neurosis. Dr. Bay concludes that in the care of patients with heart disease, detailed attention must be given to their schedule of physical activities and their emotional responses to their illness.

Blakeslee, Howard, Know Your Heart, Public Affairs Pamphlet No. 137, The American Heart Association, New York, 1948.

This pamphlet gives the trend of heart disease as a cause of death, with the present rate of 600,000 deaths per year and the possible increase to 1,200,000 by 1960. This rise is related to the present rise in age of American population but emotional and mental strain of modern living also contribute to this high death rate. The author describes the heart as the strongest and toughest of all vital organs. Its functioning is described and drawings are used to aid in this description. Heart diseases are listed. There are 21 varieties but the major forms of heart trouble are rheumatic heart disease, high blood pressure and coronary heart disease. Each is described. Then the author lists another type that he calls "functional" heart disorder. This is possibly the most widespread but with this there is nothing wrong with the heart machinery and it never kills. The fear of heart disease is a disease in its own right because of the worry and suffering it can cause. Evidence indicates that there is no occupation or trade that is a dominant factor in causing heart disease but the way of life seems to be an important influence. The two lines of attack in dealing with the problem of heart disease are treatment and prevention. A completely restored heart does not happen often but partial recovery in the sense that a person can often live a comfortable, happy, useful and often a long life is frequent. Prevention of certain heart troubles is moving ahead. In high blood pressure and coronary heart trouble, the prevention does not reach the

original causes but only the after effects; Hyperthyroidism and syphilis can be prevented. Heart disease is a tough nut to crack but in the last 30 years the medical profession's scientific organization has developed an international, medical, social, public, legislative, state and federal drive to lengthen life.

Katz, Louis, M.D., A Survey of Recent Developments Concerning the Concepts of Coronary Disease and its Management, University of Chicago Round Table No. 517, Chicago, February 15, 1948.

This paper is part of a special supplement and discusses the various kinds of coronary disease, symptoms and treatment. The treatment of coronary diseases involves more than medication. We should view with grave suspicion any tendencies to impose on the patient undue prohibitions. The patient should keep himself fit by a program of graded exercise. Exercise should be indulged in up to the point of tolerance. Inactivity even makes a healthy person physically unfit. Rest is an important item (or even a nap) as it breaks the tension of the patient. The patient should be moderate in his work or undertakings. He should learn to slow up, how to cut down and avoid peak loads and develop a carefree attitude. He should keep his weight down to normal. There is a psychological fear that all lay people and too many physicians attach to coronary episodes. We should practice the psychology of hope.

Robinson, Henry Morton, The Heart, Wondrous and Courageous Organ, Readers Digest, February 1948.

The author describes the action of the heart in a very understandable way with an accompanying diagram to aid the

reader to visualize the way the heart functions. The heart is described as a pressure pump which forces the blood with its freight of oxygen, food or waste through the vessels of the body. Driven by the heart, the five or six quarts of blood make a roundtrip about once every minute. In 24 hours the heart receives and pumps out again some 10,000 quarts of blood and expends enough energy to raise a 150 pound man to the height of the Empire State Building. The rest for this muscle is only the brief pause between the "dub" and the next "lub" but by this method it spends twice as much time relaxing as it does at work. The heart is about the size of the fist of the person and a kind of electrical timing apparatus called the pacemaker normally generates 70 times a minute a tiny electrical impulse that causes the muscle fibers to contract. In this article the author traces the course of the blood through the body, describing the function and action of each part of the heart.

White, Paul D., M.D., Good News About Your Heart, Reprinted from This Week magazine, The American Heart Association, New York, 1949.

This article discusses heart disease with the idea of preventing unnecessary worry and fear for those who have a heart condition. The author discusses new techniques in treating heart patients and says that when a heart does behave abnormally, it is not always dangerous but when a patient does have a major heart disease he has to modify some of his habits, the amount depending on what he is suffering from. The idea that a person has to stop all work is wrong. Moderate activity is just as necessary for a heart patient as for anyone else. The dread of climbing

stairs is another fallacy. Actually, walking upstairs is not harmful so long as you do not run and as long as you do not place such a strain on your heart that failure might occur. For the healthy person who wishes to avoid heart disease, a moderate amount of activity is always important but that does not mean overdoing it. Moderation and relaxing are stressed and keeping the weight normal.

White, Paul D., M.D., Facts and Fancies About the Heart, Life and Health, Part I, November 1950; Part II, December 1950.

The author states that the heart is the most efficient muscle in the body. It is practically impossible to exhaust a healthy heart as muscular and nervous fatigue and collapse occur first and protect the heart. There is much apprehension concerning the heart that needs to be dispelled. The usual pulse rate is from 50 to 90 per minute but a heart can function for years at as rapid a rate as 120 to 150 beats. Low blood pressure as low as 90 to 110 in an adult should not cause concern as it can actually lengthen life. Heart disease is not one disease but several. Less frequent but more complicated is congenital heart disease. The second important disease is rheumatic heart disease. This usually allows recovery with some permanent heart damage, variable in degree. Important new advances have been made in the treatment of rheumatic fever and rheumatic heart disease. Hypertensive heart disease seems related to our modern way of life. Heredity may play a role as well as kidney disease in some cases. Reduction in weight, slowing of pace, as well as treatment with new drugs are used as treatment. A type of nerve surgery is sometimes used as

well as a low fat and salt-free diet. Coronary heart disease comprises one-fourth of all heart disease. It often starts with brief attacks of angina pectoris which may radiate down the left arm. These first attacks start with over exertion and later attacks occur when the patient is at rest. Narrowing of coronary arteries ultimately leads to a blockage and clotting of blood in the small artery. This may end with sudden death. Early hardening of the arteries is responsible for coronary heart disease. Once the heart is affected with heart disease it does not mean permanent trouble ahead. Heart symptoms do not mean heart disease always. X-ray and electrocardiogram are not conclusive but they are valuable tests. Heart murmurs must be analyzed with care. Usually the loud murmurs are the least important. Leisurely climbing of stairs can be undertaken except when there is heart failure.

Leaman, William G. Jr., M.D., Normal Life for Heart Patients, Science Digest, February 1951.

This article republished a report appearing in the Philadelphia Bulletin. Dr. Leaman Jr. spoke before the Interstate Postgraduate Medical Association of North America. He said that complete inactivity is as dangerous as doing too much for the heart patient. It has been shown that over 70 percent of patients attending heart clinics can perform useful and productive work.

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