A study of the relationship between health knowledge and health habits of high school pupils

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A Study of the Relationship between Health Knowledge and Health Habits of High School Pupils

Marjorie Elise Beeman
A STUDY OF THE RELATIONSHIP BETWEEN HEALTH KNOWLEDGE AND HEALTH HABITS OF HIGH SCHOOL PUPILS.

BY

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THESIS

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PART I
INTRODUCTION

Statement of Proposition.

We hope to show that there is a positive relationship between the health knowledge and the health habits of the pupils in the Junior classes of high schools in certain Connecticut Valley towns by:

(1) a study of the scores of pupils from different towns on two health questionnaires;
(2) examination of the scores obtained by boys and by girls on the questionnaires;
(3) consideration of the scores on the questionnaires, obtained by pupils who have, and by those who have not studied biology or hygiene in high school; and by
(4) comparison of scores of all pupils investigated.

Purpose of the Investigation.

The purpose of this thesis is to determine whether or not there is any relationship between the health knowledge which a high school pupil possesses and the health habits which that pupil practices.

Up to the present time, there has been much health teaching, and recently its results have been
tested in various ways. Many tests of the health knowledge of high school pupils have been made in connection with specific courses in hygiene, physiology, and biology, and with lectures, camps, Boy and Girl Scout teaching, and health clubs. There have also been some studies of health habits of high school pupils by tests, observations, or physical examinations, and study of conditions resulting from certain health habits. However, there appears to have been no study of the relationship between health knowledge and health habits among high school children.

General observation has led to the assumption that knowledge of health habits, when increased by health teaching usually results in better habits. It has also been assumed that one does not practice all one knows. In this study the author attempts to determine by scientific methods what, if any, relationship there may be between the health knowledge and the health habits of pupils of the Junior classes in high schools of certain Connecticut Valley towns. It is hoped that the facts discovered will give some measure of the relationship between health knowledge and behavior among all high school pupils, and thus be adaptable to the more effective teaching of health.

If we know that there is a relationship be-
between health habits and health knowledge, we shall be better able to judge whether or not health teaching has any value.

If we know what factors influence knowledge and habits, respectively, we shall be able to make use of those factors in teaching health.

If we know the relationship between the health knowledge and habits of those pupils who have studied biology or hygiene in high school and those who have not studied the above biological subjects, we shall be able to indicate the effectiveness of our biology and hygiene classes in teaching health.

This knowledge may, therefore, be applied toward increasing the efficiency of health teaching, increasing transfer from knowledge to habit, and thus, improving the health of school children.

**Procedure.**

In choosing the group on which to carry out this investigation, it was found desirable to take pupils who had already studied biology or hygiene (if they intended to study it,) in order to consider the effect of this teaching on their knowledge and habits. Since the majority of the pupils in the high schools under observation studied biology in the Sophomore year, and
since their biological instruction had been completed recently enough for the important facts to be fresh in their minds, the pupils of the Junior class seemed to be the most suitable group.

The nature of the investigation called for two kinds of information about this group, the first pertaining to their general health knowledge, and the other concerning their actual health behavior. The only means of determining the pupil's health knowledge was to ask him in some manner. The oral method of questioning was impracticable, both because of the time consumed and because of the personal factors which might influence replies. The written test, therefore appeared to be the more feasible method. Probably a larger amount of information might have been obtained from the pupil by discussion type questions, but in order to avoid the inevitable subjectivity of such a test, a more objective type of test was chosen. This test was in the form of a questionnaire, made up of thirty questions, ten of which were multiple-choice questions to be answered by underling words which would make hygienically correct statements. The other twenty were simple, specific questions regarding proper hygienic procedure and the reasons for certain health habits. Each
of these might be answered in a very few words. The questionnaire is reproduced below.

HEALTH KNOWLEDGE QUESTIONNAIRE

Name_________________________________ Age ______

Underline all the words which would make the following statements correct.

1. A Junior in High School should sleep at least 6, 8, 10, 12 hours every night.

2. Milk, candy, fruit, green vegetables, hot dogs, coffee, bread and butter, should be eaten every day.

3. Light should strike your study table from the left, from the right, from above, from in front of you.

4. Hands should always be washed before eating anything because they look nicer, disease germs are less likely to be taken in the mouth, it is more polite.

5. You should allow everyone, no-one, your friends, to use your comb, powderpuff, towel and drinking cup.

6. You should not bite your fingernails because they grow to look ugly, there are many germs on and under them, the pieces of fingernail swallowed might make you sick, other people do not like to see you do it.

7. To keep your digestive system in good condition you should drink 6 glasses of water, eat fruit and vegetables, exercise, have bowel movement, take laxative, eat between meals, eat when you are very tired, every day.

8. You should sleep with your windows closed, open at least one inch top and bottom, wide open every night.

9. A high school pupil should smoke as often as he wants to, once in a while, never.

10. When you cough you should turn your head away from people, cover your mouth with a handkerchief, or your hand, pay no attention to where you cough.
Answer these questions briefly, complete sentences are not necessary if one word will answer the question.

11. How often should one bathe?

12. What should you do to keep the teeth in good condition?

13. How can we care for our eyes and keep them in good health?

14. How can you prevent catching colds?

15. What should you do to protect others when you have a cold?

16. Why is a clean handkerchief every day important?

17. Should a high school pupil drink tea and coffee? Why or why not?

18. What is the harm in using a towel used by others?

19. What should you do at once when you cut or scratch yourself?

20. Should any food be eaten between meals? If so what?

21. Where do we find vitamins? Why do we need them?

22. Should everyone have some outdoor exercise everyday? How much would you think necessary?

23. What is the use of sunshine in relation to your own health?

24. What is the purpose of the Schick test?

25. What is the purpose of the Dick test?

26. How much milk should you drink daily? Why?

27. Why should you put on clean clothes often?

28. Should pencils and fingers be allowed to get in your mouth? Why?
29. Should you spit on floors, sidewalks and other public places? Why or why not?

30. Why should you not drink out of a cup from which someone else has been drinking?

The health habit type of information which was needed was more difficult to obtain. The ideal method would have been to observe each child personally, at home, at school, and at play. Obviously this was impossible for a large group. Another method which would have been quite satisfactory would have been to send questionnaires about the child's health habits to the parents. However, this was not practicable, because many parents resented the inquisitiveness of the questionnaires since answers reflected the home conditions and training of the child; many parents were foreign born, (chiefly Polish,) and unable to read and write English; and parents often knew very little about their children, even in matters of health, due to business, carelessness, or the concealment of certain habits by the child.

Therefore the direct questionnaire method was again chosen as a means of obtaining information about the pupils' health habits. This questionnaire was made up of fifty questions, the first forty-two of which were simple specific questions as to definite health
habits, to be answered, in many cases by "yes" or "no", in other instances by one or two words. There was no correction for guessing, because the child was assumed to be answering, in a reasonably truthful manner, as to his own habits, not as to what he thought would be right. The basis for assuming a reasonable degree of truthfulness in answers was the article by W. W. Davis, "Questionnaire Method in Health Education", which presents evidence that answers to a questionnaire used in the health survey of a city school system may be considered truthful. Furthermore, pupils were assured that all information was to be used statistically, and not against them personally. Where possible, questionnaires were signed with numbers rather than names. However, certain habits were checked by asking for the same information in two different ways. (See questions 22 and 41 pages 10 and 11, health habit questionnaire.) The last seven questions were of the multiple-choice type, the true answer to be checked or underlined. The habit questionnaire is reproduced below.

HEALTH HABIT QUESTIONNAIRE

Name_________________________ Age____

Boy or Girl______ Have you studied Biology or Hygiene in High School?____

1. Do you eat fruit every day or nearly every day?

2. Do you take at least one hour's exercise out of doors every day? How long does it take you to walk to school, if you do walk?

3. Do you do exercises every day?

4. Do you wash your hands, arms, face, and neck every day with warm water and soap?

5. Do you brush your teeth every day?

6. Has anybody except the school nurse or doctor ever examined your eyes?

7. Does the light strike the table where you study from the left side, from above, from in front of you?

8. Do you always carry a clean handkerchief?

9. What if anything do you do to protect others when you cough?

10. Do you have many colds?

11. Do you cough much?

12. Do you gargle when you have a sore throat?

13. Do you wear high-heeled shoes for school?

14. Do you drink coffee almost every day?

15. Do you drink tea every day or almost every day?

16. Have you a comb of your own that no one else uses?

17. Do you ever use a comb which has been used by anyone else?

18. Do you always wash your hands before eating?
19. Do you bite your finger nails?

20. Do you scrub or clean your fingernails every day?

21. Would you use a towel in a theatre, church or gymnasium which had been used by anyone else?

22. Do you have a towel for your own use at home?

23. Do you ever drink out of a cup from which someone else has taken a drink?

24. Do you spit on sidewalks, floors, or other public places?

25. Have you ever had Schick test?

26. Have you ever had the Dick test?

27. Have you ever been inoculated against any contagious diseases? Which ones?

28. Do you put pencils and other such objects in your mouth?

29. Do you have a regular bowel movement every day?

30. Do you handle unwrapped food in stores?

31. Do you personally see to it that rubbish is kept out of your backyard?

32. Do you eat anything except fruit between meals?

33. Do you drink milk every day?

34. What time did you go to bed last night?

35. What time did you get up this morning?

36. Do you use either iodine, mercurychrome or other antiseptic on cuts and scratches?

37. How often do you change your stockings?

38. Where do your shoes wear out first? In the middle of the sole, near the toe?

39. Do your heels wear out faster on the outside or inside?
40. Do you try to keep your backbone straight when sitting and standing?

41. Would you ever use a towel which someone else had used?

42. Can you swim? Would you go swimming within an hour after dinner?

Underline the correct answer in each of the following.

43. Do you wake up by yourself every morning, do you have an alarm clock to awaken you, or does someone call you?

44. Do you take a bath in the tub once a week, twice a week, daily?

45. Do you go to a dentist regularly once a year, every 6 months, occasionally?

46. Do you smoke? Every day? Sometimes? Never?

47. Do you drink alcoholic beverages? Often? Sometimes? Never?


49. Do you take a laxative? Daily? Often? Occasionally?

50. Do you drink 6 glasses of water every day? 3 glasses? Less?
It would have been impossible to obtain information about every health habit or all the health knowledge which a high school child should have. Safety education, mental hygiene, and sex knowledge and behavior, all of which are important phases of health education were entirely omitted due to the practical impossibility of obtaining accurate responses. Nevertheless, these questionnaires attempt to test enough different health habits, and enough knowledge to give a good index of the attitude toward health, and an indication of the general health knowledge and habits. It will be noted that there are some questions on personal habits, in relation to cleanliness, exercise, sleep, care of feet and eyes, etc., and some on community health habits in relation to prevention of spread of disease, such as cleanliness in back yards to prevent fly and mosquito breeding, artificial immunity, and handling of food in stores.

In constructing the questionnaires, numerous high school textbooks of biology and hygiene\(^1\) were con-

\(^1\) Atwood, William H., "Civic and Economic Biology", R. Blakiston's Sons and Company, 1922.


Grunberg, Benjamin C., "Biology and Human Life", Ginn and Company, 1925.

(continued on next page)
sulted, in order to find what health habits and knowledge were most emphasized. Several lists of health questions from magazines were also consulted. A list was made of the phases of health which a high school Junior would be expected to know and practice, as suggested by reference to the above sources. About three questions were composed relative to each subject on the list. In these the writer attempted to attack the subject from three different points of view to avoid low scores due to varying points of emphasis on the same habits in different schools. These questions were then submitted to Miss Esther Davies, Assistant Research Professor of Home Economics at Massachusetts State College, who has had experience in formulating health questionnaires, especially on food problems. After discussion with Miss Davies some questions were omitted, many re-worded for easier comprehension by


Hygeia, "Can You Answer These", Vol. 5, No. 6, page 308, June, 1927.


(continued on next page)
immature minds, and a few questions added. The habit questionnaire was then given experimentally to a few high school pupils. Some questions evidently needed re-statement, and, accordingly, were changed.

The knowledge questionnaire, which was made in much the same way, and to cover practically the same phases of health, asked what the pupil believed to be the correct practice for health, and reasons for specific health procedures. Whereas, in most cases, it is advisable to have logical sequence in a questionnaire, care was taken not to have complete logical sequence here, in order to avoid suggestion of desirable answers. The habit questionnaire was presented first, in order to prevent any indications of what should be the right answer carrying over from the knowledge questionnaire.

The knowledge questionnaire did not attempt to cover all the health knowledge which a high school Junior should have, but did attempt to cover information concerning a representative group of important health habits.

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Smallwood, W.M., Revely, I.H. and Bailey, O.A. "New Biology", Allyn and Bacon, 1924.
and accepted health standards, which would indicate the amount of knowledge possessed. The questionnaire essayed to test the pupil's knowledge as to what is the best health behavior, and also his knowledge of why that specific behavior is beneficial to health.

All pupils in the classes were required to answer both questionnaires, because they were distributed by the authority of the principals of the schools. This increased the chances of random sampling, making the conclusions from this study more applicable to high school pupils in general, than if returns were less complete. Whenever, due to absence, only one questionnaire was filled out by a pupil, this was discarded. Other discarded cases were those impossible of identification because of missing or fictitious signatures.

These two sets of questionnaires were taken to the principals of certain Connecticut Valley high schools, with written instructions to the principal, asking him to collect the data on the habit questionnaire first, to see that all of them were marked with an identifying name or number, and to return a list of the intelligence quotients with them. The following note to be read to the pupils was also included.
Note to be read to the pupils before the Questionnaire is given.

These questionnaires are a part of a study of health habits in Connecticut Valley high schools. True answers are absolutely essential to obtain the necessary information. You may feel free to answer these questions truthfully, for the replies are to be used only statistically, not in connection with your name at all.

Questionnaire number one, consisting of three pages.

Most of these questions may be answered by "yes" or "no", or in a very few words. Please make your answers brief.

Questionnaire number two, consisting of two pages.

The first ten questions are to be answered by underlining the words which make the statements correct. If one word is distinctly better than the others, underline only one, but if two or more words or phrases are equally true, underline all which would make a complete statement.

Write the replies to the other twenty questions on the questionnaire, but if the space under the question is not large enough, put the number of the question and its answer on the second page after question 30. You need not make sentences of your answers, but if more than one factor contributes to the matter under consideration, be sure to state all of them.

These notes were alike for all the schools, in order to give all the pupils as nearly standard instructions as possible. The chief reasons for these notes were to increase reliability by making it perfectly clear to the pupils that their replies would not be used against them personally, and to make sure that they stated all
the factors which they knew in answer to questions.

The questionnaires were then returned and graded. All grading was done by the investigator with the exception of about 50 copies, which were graded under her careful personal supervision. In grading, all questions were given equal weight, and marked on a percent scale. This means that, in the habit test each question counted two, and, in the knowledge test each counted three and one-third percent. Accepted health standards, especially those recommended by the American Child Health Association, were used as the basis for constructing a key score which was used in correcting. All answers received for each question were given an arbitrary value according their deviation from hygienic standards accepted by reputable health workers.

Limitations of this Study.

One of the chief limitations of this study is the possibility that any difference between the score on the health knowledge tests and health habit tests may be due to an unrecognized difference in the difficulty of the tests.

The reliability of the data is also limited by the truthfulness of the replies to the questionnaires.
The necessary omission of measurement of some important health habits and knowledge in mental hygiene, safety habits, and sex behavior is another limitation.

**Historical Statement.**

Anatomy, physiology, biology, and, in some cases, hygiene, have long been taught in high school, but the teaching of health in high schools is of relatively recent date. The creation of the Society for Prevention of Cruelty to Children in 1875 was the first recognition of official responsibility for child health and welfare in this country, and the first division of child hygiene of a municipal health department was that established in New York in 1908, but the growth of such organizations has been very rapid since that time, and today we have a large number of national, federal, county, municipal, and private organizations which are working for child health in this country. Some of the most important of these are the American Child Health Association, United States Public Health Service, the Metropolitan Life Insurance Company, American Medical Association, American Social Hygiene Association, National Tuberculosis Association, and National Education Association. All are doing important work in teaching
health, and are of great assistance to the schools in their health work. Health teaching is obviously of no value unless it improves the health knowledge and actual health of both the individual child and the race, so as soon as health teaching was established, and even before it was standardized at all, health workers desired to measure results.

Several means for determining results of health teaching have been attempted. At first the health worker was concerned as to whether or not the child was profiting in increased knowledge by the teaching, and the early tests attempted to measure the extent of this knowledge. Soon workers wished to ascertain the results in better health habits and improved health status, and accordingly devised means for so doing. At present the results of health teaching are checked by (1) anatomical and physiological measures of health status such as physical examinations, corrections of defects, weight for age and height, posture photographs, less lassitude, and decrease in absences from school; (2) by written tests of health knowledge, theses, and posters; (3) writ-

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ten tests and observations of health attitude; (4) observations of health activities, such as noting lunches chosen at cafeteria, home projects in health, daily personal inspection of hands, fingernails, and general appearances in school, and observations of reading and posture habits; (5) self checking on health practices with use of score cards, daily diaries, or occasional habit questionnaires; (6) rating of others on health practices, as in the "Guess Who" type of test where a child is asked to name the child in the room whose habits correspond with those of a description; and (7) demonstrations of health skills and knowledge such as are required for Red Cross, Boy and Girl Scout, and Camp Fire Girl badges and certificates.

Since we are concerned only with health knowledge and health habits in this study we may pass over the other types of measurement without discussion. Very little has been accomplished in the study of the relationship between health knowledge and health habits, but it is necessary to have a background of history for each of these items separately in order to understand the significance of any work done on both of them.

Many tests of health information have been composed. Some of these were in the form of ordinary
classroom examinations in the school subject in connection with which health was taught. Such tests have been given by practically every school teacher of biology, hygiene, and physical education, and are too numerous and too common to need discussion. Aside from the classroom examinations, written health knowledge questionnaires have been devised by most of the efficient county and city health organizations, private investigators interested in health, and by the research departments of national organizations. These have been in the nature of written and oral health questionnaires, and written tests of the true-false, completion and multiple choice types, and the story test described by Franzen. Of these the only objective and reliable tests developed so far are the "Gates-Strang Health Knowledge Test" made by Arthur Gates and Ruth Strang of Columbia University, and the tests investigated by Raymond Franzen of the American Child Health Association. The Gates-Strang test is made for use in grades three to twelve, and is composed

1. Franzen, Raymond, "Health Education Tests - American Child Health Association, 1929.
of 64 questions of the multiple choice type, to be answered by placing a check before the correct answer. This test consists of questions on food, ventilation, posture, sanitation, disease prevention and control, accident prevention and body care. It is inclusive, covering practically all the important phases of health except mental and sex hygiene. It is the consensus of opinion that the Gates-Strang test is the best health knowledge test yet devised. Franzen's test series consists of five separate tests. The first contains a number of rules of health, and the pupil is to mark the five rules which he would like to follow for one month. This is primarily a choice test, but also measures information. The second is a group of stories, containing health issues, and the child is to underline the things good for health and cross out those which are bad for health. The third, the so-called "Time Test" consists of a list of health activities which the child is to mark as to whether they should be done once a day, once a week, or once a year. The fourth is a matching test in which articles or activities are to be matched with statements or characterizations printed in another column. The fifth is a true-false test of items regarding health.

As is the case with the health knowledge tests,
many health habit tests have been devised. One of the
more original and interesting was the method used by
Dr. Stella B. Vincent of the Department of Psychology,
Chicago Normal School. This was not a formal test at
all, but a requirement that the pupils in her class keep
a complete diary for one month, entered every half hour,
of exactly what they were doing, why, and whether they
enjoyed it, and any other emotional reactions. This was
intended to indicate physical health, actual habits, and
mental health.

In New Jersey, the Huntington County Health
Association has outlined an oral habit questionnaire to be used in the daily and weekly school inspection of
the Huntington County Health Clubs. The daily inspection
questionnaire asks specific and objective questions about
ten important health habits of the preceding day. The
weekly questions were only two, "Did you take a bath last
week"? and "Did you use your own towel and drinking cup
every day last week"?

In connection with nutrition work, food scores
and questionnaires are often published. An example of

1."Report of the Chicago Health Education Conference"—
American Child Health Association, 1926, page 117.
2.Baker, S. Josephine—"Child Hygiene"—Harpers 1925,
       pages 461-463
these may be found on the back of the Extension Leaflet 130, Massachusetts State College Extension Service. This is excellent in regard to food habits, but, of course, does not test any other habits.

Professor C. E. Turner of Massachusetts Institute of Technology who directed the "Malden Studies in Health Education\(^1\) used a habit questionnaire to send to parents and children, and checked this with individual health records, group records of growth, opinions of teachers, nurses, and principals. His questionnaire was based on the questionnaire used by the American Child Health Association in their survey of eighty-six cities, and was checked with it. The "Rules of the Health Game"\(^2\) have been made the basis of health questionnaires. One such is that used at the Westfield, Massachusetts, High School, as a basis for health teaching.

While the habit questionnaire used by the American Child Health Association in the "Health Survey of 86 Cities" was originally devised for the pupils of the fifth grade, it has been used for so many high school health habit questionnaires that it is necessary to speak of it somewhat fully. This test consists of 15 questions

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2. "Rules of the Health Game", American Child Health Association, N.Y.C.
covering habits of sleep, breakfast, noon lunch, whether or not the child played out of doors, what and where he played. This last question contained a list of places where a child might play, and he was supposed to check one or more of them. Other questions were asked as to the number of glasses of milk and cups of coffee drunk, brushing of teeth, going to the dentist, days lost from school the previous week, and whether or not a baby was born in the family within the last six months. This last question was included as a check on registration of births. Whenever possible, questions were asked regarding the previous day only, in order to avoid generalities. Questions were definite and objective, and this habit questionnaire is regarded as the outstanding test of its kind so far produced.

The only correlated health knowledge and habit test was that used by Juliet Bell in 1925,¹ while Director of County Health Demonstration at Kalamazoo, Michigan, in a study of one-room elementary schools. This health knowledge test was one made in 1924 but improved by the use of the Gates-Strang test. Miss Bell considered that the habit test which she used need further revision. By

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¹ Bell, Juliet, American Child Health Association-- "Transactions of the Third Annual Meeting 1926", Vol. III, Part II, page 47.
the use of these correlated tests, habit performance was found to be inferior to knowledge, showing that one does not always do as well as he knows how in health.

No study of the relationship between health knowledge and health habits has been carried out in regard to high school pupils up to the present time.
PART II
PRESENTATION OF DATA

I
Comparison of Towns

The original plan of the investigator was to collect data from nine Connecticut Valley towns, three of which were small rural towns, two of which were towns having five thousand to eight thousand inhabitants, and four larger communities ranging in population from fifteen thousand to forty-one thousand. This was expected to give a normal sampling of the various types of communities in the Connecticut Valley. However, of the nine towns, it has been necessary to omit the use of four, two of which failed to identify the questionnaires by names or numbers, making correlation and statistical interpretation impossible, and two of which did not return their reports in time to be considered at the present writing. This left five towns having environmental conditions approximately average for the Connecticut Valley. These towns were Amherst, Chicopee, Greenfield, Westfield and West Springfield, which I shall hereafter designate as T1, T2, T3, T4, and T5, respectively. Amherst is a college town of five thousand inhabitants. General standards of living within the town are high, but a portion of the school
population lives on onion and tobacco farms in the outlying districts, in which standards of living tend to be lower. Chicopee is distinctly an industrial city with a population of forty-one thousand. Greenfield is a town of fifteen thousand inhabitants and of moderate industrial activities. A State normal school is located at Westfield, a typical western Massachusetts town of nineteen thousand inhabitants. West Springfield, a town in which market gardening and manufacturing are the chief occupations, is also a residential suburb of the city of Springfield.

Pupils' scores on the health questionnaires were classified and studied by towns in order to help indicate what environmental factors might influence their knowledge and health habits.

The most common method of comparing a group of factors is by a consideration of statistical averages. Of the various types of statistical averages, the best known is the arithmetical mean, determined by dividing the sum of the scores by the number of cases studied. The arithmetical mean of the scores obtained in each town on each test is set forth in the following table.
**Figure I**

Table of average scores for each town, each test

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<th>Town</th>
<th>T1</th>
<th>T2</th>
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<td>(2) Knowledge Questionnaire</td>
<td>80.0</td>
<td>71.0</td>
<td>75.0</td>
<td>80.0</td>
<td>76.0</td>
<td>9.0</td>
</tr>
<tr>
<td>(1) Habit Questionnaire</td>
<td>71.5</td>
<td>71.0</td>
<td>70.5</td>
<td>73.0</td>
<td>71.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Difference</td>
<td>8.5</td>
<td>0.0</td>
<td>4.5</td>
<td>7.0</td>
<td>5.0</td>
<td></td>
</tr>
</tbody>
</table>

It may be seen that the average score was higher on the knowledge questionnaire than on the habit questionnaire, in all but one of the towns (T2), in which the average scores were the same in both questionnaires. This would indicate that it was the average tendency of pupils to know more about health than they put into practice in their own health habits. However, after noting the difference between the average scores on the two tests we see a range of variation from zero to 8.5 in the different towns which suggests that some factors within the town influence variations in the relationships between health knowledge and behavior. Moreover, it is noteworthy that health knowledge scores were never lower than scores on health habits, yet in no case was there a difference of more than eleven points.
on a percentage scale, between knowledge and habit scores.

Referring again to Figure I, we note that there is only a slight variation (2.5 points) between the average scores obtained by the different towns on the habit questionnaire (#1), but there is a larger difference (9 points) between the average scores obtained on the knowledge questionnaire (#2), which indicate a greater variation in knowledge than in habits.

A second form of statistical average which is used in comparing groups of data is the mode. The mode is that point in the ranking scale at which the scores of the largest number of cases within a group fall. The following table presents the mode for each town in each test.

**Figure II**

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) Knowledge Questionnaire</td>
<td>77.0</td>
<td>85.0</td>
<td>75.0</td>
<td>90.0</td>
<td>85.0</td>
<td>10.0</td>
</tr>
<tr>
<td>(1) Habit Questionnaire</td>
<td>82.0</td>
<td>87.0</td>
<td>82.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>83.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference (greatest)</td>
<td>20.0</td>
<td>8.0</td>
<td>13.5</td>
<td>7.5</td>
<td>13.5</td>
<td></td>
</tr>
</tbody>
</table>
With the mode as with the mean, the scores on the knowledge questionnaire are higher than those on health habits. Of these modes one is triple (T1, #2), and two are double (T3, T4, #2) a condition which theoretically should not exist, and will be considered in detail later (see Part III, page 73). Noting the variation between the modes of the habit questionnaire and the modes of the knowledge questionnaire, we find that the greatest variation is between the low mode (83) of T1 on the habit questionnaire and the 83 which is the highest of the triple mode of T1 on the knowledge questionnaire, a total difference of 20 points. If we exclude the figures for T1, the greatest difference is 13.5.

A third type of statistical average used in comparing groups of data is the median. The median is that point on the scoring scale, above and below which an equal number of cases fall. The following table shows the median scores of the pupils of each town on each test. Here we find a difference of 2.5 points among the scores on test #1 and a variation of 9 points among the scores on test #2. However, the differences in the median scores on test #1 and test #2, ranging from 1 to 9, is still within the eleven points varia-
tions noted above.

Figure III

Table of median scores for each town, each test

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Questionnaire</td>
<td>81.0</td>
<td>72.0</td>
<td>76.0</td>
<td>80.0</td>
<td>78.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Habit Questionnaire</td>
<td>72.0</td>
<td>71.0</td>
<td>71.5</td>
<td>73.5</td>
<td>71.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9.0 1.0 4.5 6.5 6.5</td>
</tr>
</tbody>
</table>

In order to portray graphically an existing relationship between health habits and health knowledge, the frequency polygon has been used. The frequency curve or smoothed polygon is often used for treatment of similar data where it is desirable to reduce the irregularity due to individual variations. However, the frequency polygon is considered to represent the most probable distribution of cases within the groups, more accurately than the histogram or the smoothed frequency curve. It also shows variations better, so it was considered the most feasible type of frequency curve to use to bring out peculiarities which might point toward the influencing factors. Accordingly, two frequency polygons of scores grouped into class-

---

Frequency polygons of scores of town I on test 1 (blue) and test 2 (red).
intervals of five points, were constructed for each town, on the same sheet of graph paper in order to make comparison easier. The polygons of scores on the health habit questionnaire were made in blue, and the scores on health knowledge were made in red. In considering the polygons made for T1, it is easily seen that the health knowledge scores were higher than the health habit scores. Even in the high and low scores, we find that knowledge exceeds habit since the low score of test #1 is in the 50-54 group, whereas the low score of test #2 is in the 55-59 group, and the high score of the habit questionnaire is in the 93-94 group, while the high score of the knowledge questionnaire is at 95 or above. However, the general forms of the polygons do not closely correspond, indicating that the relationship between the knowledge and the habits of the group as a whole, while existing, is not close.

On investigation of the frequency polygon for 72, we find a considerably higher degree of correspondence than in T1. The high score on the knowledge test is above the highest on the habit test, but the lowest score is also lower on the knowledge test although the variation is not very great. Examination of the frequency polygon for T3 and T5 will show that in both cases there is a slight agreement in general form, that knowledge scores
Frequency polygons of scores of town 2 on test 1 and test 2. (blue) (red)
in these cases are also higher than in habit scores, and the difference between the two scores is not more than eleven.

In the polygon for T4, we find the same general form of curve for each test, yet they do not correspond as closely as the frequency polygons for T2, T3, and T5. Nevertheless, the amount of variation between the habit questionnaire and the health knowledge questionnaire is about the same as that of the polygons for the other towns.

For further comparison polygons for each town on the same test were constructed on one paper. Since all towns differed in number of cases, the frequency in actual number of cases was translated into percentage of the total score for the town, in order to make visual comparison possible. On examination of the polygons for all towns on the habit questionnaire (Fig XI), it may be noted that there are many slight individual peculiarities of form, but that the general form of all the frequency polygons is the same. This indicates that in general the health habits of the pupils of the Junior classes of high school are the same throughout these towns, and probably throughout the Connecticut Valley, but that environmental factors within the towns produce some variations.

Turning next to the frequency polygons for all
Frequency polygons of scores of town 3 on test 1 and test 2.
(blue) (red)
Figure VII

Frequency polygons of scores on town 4 on test 1 and test 2.
(blue) (red)
Frequency polygons of scores of town 5 on test 1 and test 2. (blue) (red)
the towns on the health knowledge questionnaire (Fig. XII), a much greater variation is seen. There is a slight agreement with the general form, but the deviations from it are so numerous and so varied that we may assume that the health knowledge of pupils in the various towns differ from the habits in that it varies greatly from town to town.

The table of modes of the frequency polygons shows the larger variation between towns in health habits than in knowledge, and that variation between the knowledge and habits does not exceed 11 points in any town. It also calls attention to the small amount of variation from town to town, when scores are grouped with a class-interval of five points.

In an attempt to discover whether or not there was any definite relationship between health knowledge and habits, the coefficient of correlation between the scores on test #1 and test #2 for each town was computed according to the Pearman method. The coefficients of correlation are presented in the following table. "The coefficient of correlation is a numerical index of the relationship between two sets of paired facts." Authorities do not agree as to

Figure IX

Coefficients of correlation between scores on health knowledge and health habit questionnaires.

<table>
<thead>
<tr>
<th>Town</th>
<th>Coefficient of Correlation</th>
<th>Probable Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>.18</td>
<td>±.09</td>
</tr>
<tr>
<td>T2</td>
<td>.36</td>
<td>±.05</td>
</tr>
<tr>
<td>T3</td>
<td>.26</td>
<td>±.06</td>
</tr>
<tr>
<td>T4</td>
<td>.17</td>
<td>±.06</td>
</tr>
<tr>
<td>T5</td>
<td>.26</td>
<td>±.06</td>
</tr>
</tbody>
</table>

what may be considered a reliable coefficient of correlation. Some set an arbitrary standard at 40, others at 30, and some judge its value according to the ratio between the coefficient and the probable error. If a correlation must have a positive coefficient of more than 40, there is no positive correlation at all between health knowledge and health habit of these high school pupils as measured by the questionnaires. However, when a coefficient of correlation of 30 is considered to show a definite relationship that of T2 may be said to show that there is a positive relationship between the health habits, and the health knowledge of the pupils of the high school in T2. Applying the conservative ratio between the probable error and the
Figure X.

Table of modes of frequency polygons for each town.

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit Questionnaire</td>
<td>70-74</td>
<td>65-69</td>
<td>70-74</td>
<td>70-74</td>
<td>70-74</td>
<td>5</td>
</tr>
<tr>
<td>Knowledge Questionnaire</td>
<td>80-84</td>
<td>70-74</td>
<td>75-79</td>
<td>80-84</td>
<td>80-84</td>
<td>10</td>
</tr>
<tr>
<td>Difference</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

coefficient of correlation which is approved by Monroe\(^1\) of 1 to 4, we find that T2, T3, and T5 indicate a positive relationship.

Frequency polygons of scores of all towns on test I.
Figure XII

Frequency polygons of scores of all towns on test 2.
II

Comparison of Boys and Girls

In the preceding section, we have presented data concerning pupils grouped according to the towns in which they attend high school, in order that they may be used to suggest whether or not environmental factors influence the relationship between health habits and health knowledge. Another factor which might influence health habits or knowledge and therefore also influence the relationship between them is the sex of the pupil. There has been a common assumption, based on general observation, that girls are more careful than boys in matters of cleanliness and health. It shall be the purpose of section II to set forth data which may be used to indicate whether or not this assumption is well founded in the case of these Connecticut Valley high school pupils; and whether their sex influences the relationship between health knowledge and habits. The simplest, clearest, and therefore, the most effective method of comparing the scores of the boys and girls appears to be the use of the arithmetical mean. This type of average will be used throughout the discussion of the influence of sex on health habits and knowledge.
Figure XIII

Table of averages of all girls' scores each town, each test

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Questionnaire</td>
<td>79.6</td>
<td>72.8</td>
<td>78.7</td>
<td>80.3</td>
<td>79.2</td>
</tr>
<tr>
<td>Habit Questionnaire</td>
<td>71.6</td>
<td>72.3</td>
<td>72.1</td>
<td>74.2</td>
<td>72.7</td>
</tr>
<tr>
<td>Difference</td>
<td>8.0</td>
<td>.5</td>
<td>6.6</td>
<td>6.1</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Figure XIV

Table of averages of all boys' scores each town, each test

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Questionnaire</td>
<td>80.0</td>
<td>69.9</td>
<td>71.5</td>
<td>78.9</td>
<td>71.5</td>
</tr>
<tr>
<td>Habit Questionnaire</td>
<td>71.0</td>
<td>70.0</td>
<td>69.5</td>
<td>73.7</td>
<td>69.0</td>
</tr>
<tr>
<td>Difference</td>
<td>9.2</td>
<td>.1</td>
<td>3.0</td>
<td>5.2</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Figure XIII shows the average scores of all girls of each town in each test, and Figure XIV presents the averages of all the boys in each town in each test. In Figure XIII, we see that in every town group the
score of the girls is higher on test \#1 than on test \#2. This means that for groups classified according to sex the health knowledge of girls is always greater than their health habits as measured by the questionnaires.

In Figure XIV, there is a case (T2) in which, among boys, the pupils have better health habits than their knowledge would indicate. We shall consider this situation later in the discussion (see chapter 3, page 70).

**Figure XV**

<table>
<thead>
<tr>
<th>Table of average scores of all boys and all girls, each test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Questionnaire</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Habit Questionnaire</td>
</tr>
<tr>
<td>Difference</td>
</tr>
</tbody>
</table>

Combining these scores for all the boys in all towns and all the girls in all towns for each test, we find that knowledge scores are higher than habit scores. However, the averages of boys' scores are lower than the averages of girls' scores in both tests.

In Figures XVI and XVII average scores for each test, of the girls in each town who had studied biology or hygiene in high school are compared with the average
Table of average scores of girls and boys who have studied biology or hygiene for each town, test #1

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>71.6</td>
<td>69.6</td>
<td>72.9</td>
<td>73.8</td>
<td>72.5</td>
</tr>
<tr>
<td>Boys</td>
<td>71.7</td>
<td>72.1</td>
<td>67.4</td>
<td>75.5</td>
<td>69.7</td>
</tr>
<tr>
<td>Difference</td>
<td>-0.1</td>
<td>-2.5</td>
<td>5.5</td>
<td>-1.7</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Table of average scores of girls and boys who have studied biology or hygiene for each town, test #2.

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>79.4</td>
<td>71.5</td>
<td>79.7</td>
<td>81.0</td>
<td>79.3</td>
</tr>
<tr>
<td>Boys</td>
<td>79.0</td>
<td>70.6</td>
<td>70.1</td>
<td>79.8</td>
<td>71.6</td>
</tr>
<tr>
<td>Difference</td>
<td>0.4</td>
<td>0.9</td>
<td>9.6</td>
<td>1.2</td>
<td>7.7</td>
</tr>
</tbody>
</table>

scores of the boys in the same towns who had studied these subjects. The girls' scores are all higher on the knowledge questionnaire. However, examination of the average scores of boys and girls who had received health teaching in connection with high school courses shows that boys' scores are higher than those of girls in three-fifths of the towns (T1, T2, and T4). These scores suggest that boys in towns 1, 2 and 4 have better health habits than the girls, whereas the girls in T3
and T5 have better health habits than the boys. Furthermore, we may note that the difference between the average of boys and girls is in no case very great.

Figure XVIII

Table of average scores of girls and boys who have not studied biology or hygiene for each town, test #1

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>71.6</td>
<td>73.3</td>
<td>74.1</td>
<td>74.4</td>
<td>74.0</td>
</tr>
<tr>
<td>Boys</td>
<td>69.9</td>
<td>67.0</td>
<td>69.9</td>
<td>72.0</td>
<td>64.7</td>
</tr>
<tr>
<td>Difference</td>
<td>1.7</td>
<td>6.3</td>
<td>4.2</td>
<td>2.4</td>
<td>9.3</td>
</tr>
</tbody>
</table>

It will be noted that in Figure XVIII the scores of girls on the habit questionnaire are higher in every town when both boys and girls have not studied biology or hygiene in high school. In Figure XVIV the girls’ scores on the knowledge questionnaire are all higher than the boys’ scores, except in T1 where the boys’ average score is higher than the girls’ average score.

Finally, in our study of the scores of boys and girls, we submit Figures XX and XXI, in which there is a comparison of all the boys with all the girls for each town on each test. In all these cases the girls are better than the boys, with the exception of T1, in
### Figure XVIX

Table of average scores of girls and boys who have not studied biology or hygiene for each town test, #2.

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>80.1</td>
<td>73.8</td>
<td>77.6</td>
<td>79.9</td>
<td>78.7</td>
</tr>
<tr>
<td>Boys</td>
<td>82.3</td>
<td>68.9</td>
<td>73.3</td>
<td>78.0</td>
<td>71.0</td>
</tr>
<tr>
<td>Difference</td>
<td>-2.2</td>
<td>4.9</td>
<td>4.3</td>
<td>1.9</td>
<td>7.7</td>
</tr>
</tbody>
</table>

### Figure XX

Table of average of all boys and all girls, each town, test #1

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>71.6</td>
<td>72.3</td>
<td>72.1</td>
<td>74.2</td>
<td>72.7</td>
</tr>
<tr>
<td>Boys</td>
<td>71.0</td>
<td>70.0</td>
<td>68.5</td>
<td>73.7</td>
<td>69.0</td>
</tr>
<tr>
<td>Difference</td>
<td>.6</td>
<td>2.3</td>
<td>3.6</td>
<td>.5</td>
<td>3.7</td>
</tr>
</tbody>
</table>

### Figure XXI

Table of average of all boys and all girls, each town, test #2

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>79.6</td>
<td>72.8</td>
<td>78.7</td>
<td>80.3</td>
<td>79.2</td>
</tr>
<tr>
<td>Boys</td>
<td>80.2</td>
<td>69.9</td>
<td>71.5</td>
<td>78.9</td>
<td>71.5</td>
</tr>
<tr>
<td>Difference</td>
<td>-.6</td>
<td>2.9</td>
<td>7.2</td>
<td>1.4</td>
<td>7.7</td>
</tr>
</tbody>
</table>
which the boys have consistently been higher than the girls, in their scores on the health questionnaire, in different forms of comparison. (see Part III, page 87).
III

Comparison of Pupils Who Have Studied Biology or Hygiene in High School and Pupils Who Have not Studied These Subjects

In investigating the possible relationship between health habits and health knowledge, it is expedient to study the scores obtained by those pupils who have studied biology or hygiene in high school and those who have not studied these subjects, since these two subjects are those in which health teaching is most commonly carried out in Connecticut Valley high schools.

Figure XXII

Table of scores of girls who have and have not studied biology or hygiene, each town, test #1.

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology or Hygiene</td>
<td>71.5</td>
<td>69.6</td>
<td>72.9</td>
<td>73.8</td>
<td>72.5</td>
</tr>
<tr>
<td>No. Biology or Hygiene</td>
<td>71.6</td>
<td>73.3</td>
<td>71.1</td>
<td>74.4</td>
<td>74.0</td>
</tr>
</tbody>
</table>

| Difference | -0.1 | -3.7 | 1.8 | -0.6 | -1.5 |

From the above table, which sets forth the average scores of the girls who have studied biology or hygiene in high school, for each town, it is seen that
in most towns, the average scores of girls who have not had such health teaching is higher than the scores of those who have studied biology or hygiene. This indicates that, in most cases, the health teaching of such courses has no effect on health habits of girls, and in fact, that girls who studied biology or hygiene are more careless as to their health practices than those who have not studied biological subjects. In one town, T3, the girls who have had health teaching are higher in average score than those who have not studied these biological subjects.

Figure XXIII

Table of scores of girls who have and have not studied biology or hygiene, each town, test #2

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology or Hygiene</td>
<td>79.4</td>
<td>71.5</td>
<td>79.7</td>
<td>81.0</td>
<td>79.3</td>
</tr>
<tr>
<td>No Biology or Hygiene</td>
<td>80.2</td>
<td>73.8</td>
<td>77.6</td>
<td>79.9</td>
<td>78.7</td>
</tr>
<tr>
<td>Difference</td>
<td>- .8</td>
<td>- 2.3</td>
<td>2.1</td>
<td>1.1</td>
<td>.6</td>
</tr>
</tbody>
</table>

Figure XXIII shows that in three towns, knowledge of girls who studied biology or hygiene, as indicated by the health knowledge questionnaire, was greater than that of those girls who did not study such
subjects, but that in two towns, T1 and T2, those who received health teaching had lower average scores than those who did not. It should also be noted, here, that in T2 only about one-third of the total number of girls studied biology or hygiene at all in high school.

**Figure XXIV**

Table of scores of boys who have and have not studied biology or hygiene, each town, test #1

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology or Hygiene</td>
<td>71.7</td>
<td>72.1</td>
<td>67.4</td>
<td>75.5</td>
<td>69.7</td>
</tr>
<tr>
<td>No Biology or Hygiene</td>
<td>70.0</td>
<td>67.0</td>
<td>69.9</td>
<td>72.0</td>
<td>64.7</td>
</tr>
<tr>
<td>Difference</td>
<td>1.7</td>
<td>5.1</td>
<td>-2.5</td>
<td>3.5</td>
<td>5.0</td>
</tr>
</tbody>
</table>

**Figure XXV**

Table of scores of boys who have and have not studied biology or hygiene, each town, test #2

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology or Hygiene</td>
<td>79.0</td>
<td>70.6</td>
<td>70.1</td>
<td>79.8</td>
<td>71.5</td>
</tr>
<tr>
<td>No Biology or Hygiene</td>
<td>82.3</td>
<td>68.9</td>
<td>73.3</td>
<td>78.0</td>
<td>71.0</td>
</tr>
<tr>
<td>Difference</td>
<td>-3.3</td>
<td>1.7</td>
<td>-3.2</td>
<td>1.8</td>
<td>.5</td>
</tr>
</tbody>
</table>
Comparison of the average scores of the boys who have studied biology or hygiene and those who have not, for each town, on both questionnaires shows that, in general, the scores of those boys who have studied the above biological subjects are higher than those of the boys who did not have that health teaching. However, the boys of T3 on both tests, and those of T1 on the knowledge questionnaire, who did not receive biology or hygiene training, have higher scores than those who did have it.

Figure XXVI

Table of scores of all who have and have not studied biology or hygiene, each town, test #1

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology or</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hygiene</td>
<td>71.6</td>
<td>71.2</td>
<td>68.2</td>
<td>74.6</td>
<td>71.4</td>
</tr>
<tr>
<td>No Biology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or Hygiene</td>
<td>70.8</td>
<td>71.4</td>
<td>72.3</td>
<td>73.5</td>
<td>70.5</td>
</tr>
<tr>
<td>Difference</td>
<td>.8</td>
<td>-.2</td>
<td>-4.1</td>
<td>1.1</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Figures XXVI and XXVII present, on each test, for each town, the average scores of all the pupils (regardless of sex) who studied biology or hygiene in high school. In Figure XXVI, the scores of the habits of those who did not study them in T2 and T3.
Table of scores of all who have and have not studied biology or hygiene, each town, test #2

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology or Hygiene</td>
<td>79.2</td>
<td>70.9</td>
<td>72.9</td>
<td>80.4</td>
<td>75.3</td>
</tr>
<tr>
<td>No Biology or Hygiene</td>
<td>81.1</td>
<td>82.3</td>
<td>75.6</td>
<td>79.2</td>
<td>75.8</td>
</tr>
<tr>
<td>Difference</td>
<td>-1.9</td>
<td>-11.4</td>
<td>-2.7</td>
<td>1.2</td>
<td>.5</td>
</tr>
</tbody>
</table>

three other towns (T1, T4 and T5), although the balance is in favor of pupils who studied the above subjects, it is not very great.

Turning to figure XXVII, it is easily seen that in three towns the knowledge of the pupils who did not study biology of hygiene scores higher than the knowledge of those who did study these subjects. Here, again, it may be noted, that in cases (T4 and T5) in which the larger score was obtained by the pupils who studied the above-mentioned subjects, this score was hardly significantly larger. In fact, in both Figure XXVI and Figure XXVII, we find the variation between the different towns within the group considerably greater than the variances between the groups.

The data in the preceding figures (XXVI and XXVII was recombined in Figures XXVIII and XXIX to show
the relationship between the health knowledge and health habits as measured by the health questionnaire, when pupils were grouped as to whether or not they studied biology or hygiene in high school.

**Figure XXVIII**

Table of average scores of all pupils who have studied biology or hygiene in high school, test #1 and test #2

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Questionnaire</td>
<td>79.2</td>
<td>70.9</td>
<td>72.9</td>
<td>80.4</td>
<td>76.3</td>
</tr>
<tr>
<td>Habit Questionnaire</td>
<td>71.6</td>
<td>71.2</td>
<td>68.2</td>
<td>74.6</td>
<td>71.4</td>
</tr>
<tr>
<td>Difference</td>
<td>7.6</td>
<td>- .3</td>
<td>4.7</td>
<td>5.8</td>
<td>4.9</td>
</tr>
</tbody>
</table>

**Figure XXIX**

Table of average scores of all pupils who have not studied biology or hygiene in high school, test #1 and #2

<table>
<thead>
<tr>
<th>Town</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Questionnaire</td>
<td>81.1</td>
<td>82.3</td>
<td>75.6</td>
<td>79.2</td>
<td>75.8</td>
</tr>
<tr>
<td>Habit Questionnaire</td>
<td>70.8</td>
<td>71.4</td>
<td>72.3</td>
<td>73.5</td>
<td>70.5</td>
</tr>
<tr>
<td>Difference</td>
<td>10.4</td>
<td>10.9</td>
<td>3.3</td>
<td>5.7</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Even grouped in this way, knowledge of health, as measured by the questionnaire is found to be superior to the health
habits of the pupils in both groups, when measured by the habit questionnaire, in all cases but one (T2, Fig. XXVIII). The relationship, if any, between health habits and health knowledge, as measured in this study, seems to be closer among pupils who have studied these biological subjects than among those who have not had this training, according to the differences shown in Figures XXVIII and XXIX.

In order to show, graphically, any possible relationship between the scores obtained on the health questionnaire by those who did, and those who did not study biology or hygiene, four frequency curves were constructed. Of these the histogram on the habit questionnaire, (Fig. XXX) represents the scores of all pupils on this test, and indicates that, while the scores of pupils who studied biology and hygiene are higher than those of pupils who did not do so, nevertheless, in general, they correspond very closely. Figure XXXI shows a similar condition in regard to the knowledge of pupils as measured by the health questionnaires. Again, scores of those who studied subjects related to health in high school are slightly higher than others in their scores of health knowledge, but in general, knowledge is much the same throughout the whole group.
Histograms of scores of pupils who have (blue) and have not (red) studied biology or hygiene in high school, test 1.
Histograms of scores of pupils who have (blue) and have not (red) studied biology or hygiene in high school, test 2.
The other two frequency curves are in the form of polygons. Figure XXXII shows the distribution of all the scores of those who have studied biology or hygiene in high school, on each of the tests. The blue polygon, representing the health habit scores shows that even among pupils who have had this health teaching, their habits do not score as high as their knowledge, represented by the red polygon. Figure XXXIII indicates that the same general situation obtains for pupils who have not studied biology or hygiene in high school. However, scores correspond more closely among those who have not studied biology than among those who have studied it.

Another method used for comparing two sets of data is the coefficient of correlation. In this case a correlation was made between the scores representing health knowledge and the scores representing health habits for both the group which studied biology or hygiene in high school and the group which did not study these subjects. Since each coefficient of correlation indicates the relationship between the habits and knowledge of its group, comparison of these should show whether or not the relationship is the same in each case. In order to standardize the groups, the pupils who had not studied biology or hygiene in high school, being the smaller
group, were listed with their Intelligence Quotients. Then pupils with correspond I.Q.s were chosen from the group of those who had studied these subjects. The Intelligence Quotients were determined from Terman A test in T1, and either Terman A or B in T5. Since it was not possible to obtain the I.Q.s from all schools, the group for correlation was not large. There are 80 cases. The Pearson Method\(^1\) was used for determining the coefficients of correlation, in this case. In the group who did not study biology or hygiene in high school, the coefficient of correlation was .15 ± .08. In the group which did study these subjects the coefficient of correlation was .06 ± .08. This means that there was so little correlation, in each case, that we are justified in saying that no relationship at all was shown in such groups. The fact that the coefficient of correlation was twice as large among those who did not study biology or hygiene in high school, as among those who did study these, suggests that the relationship indicated elsewhere may be greater when no biological teaching has been received, but the coefficients of correlation are both so small that no really definite conclusions can be drawn.

Frequency polygons of scores of pupils who have studied biology or hygiene in high school, test 1 (blue) and test 2 (red).
Frequency polygons of scores of pupils who have not studied biology or hygiene in high school, test I (blue) and test 2 (red).
IV

Comparison of Ungrouped Scores

In studying the relationship between health habits and health knowledge of certain high school pupils, we have, thus far, presented the data concerning such knowledge and habits when pupils are grouped according to the towns in which they attend school, their sex, and whether or not they have studied biology or hygiene in high school. Now we shall consider the data derived from the two sets of questionnaires when the pupils are ungrouped.

Mean of all scores, each test

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit questionnaire</td>
<td>71.58</td>
</tr>
<tr>
<td>Knowledge questionnaire</td>
<td>75.00</td>
</tr>
<tr>
<td>Difference</td>
<td>3.42</td>
</tr>
</tbody>
</table>

The arithmetical mean of the scores on each questionnaire, presented above, is significant. There is a definite difference between the mean of questionnaire #1 and questionnaire #2, showing that, when pupils are ungrouped, the questionnaire scores indicate that pupils know more about health than they practice.

Comparing the data for the two questionnaires by use of the median score in each, we find that the
Median of all scores, each test

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit questionnaire</td>
<td>72.5</td>
</tr>
<tr>
<td>Knowledge questionnaire</td>
<td>77.0</td>
</tr>
<tr>
<td>Difference</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Median of the knowledge questionnaire scores is higher by 4.5 points, than is the median for the health habit questionnaire.

Similarly, a frequency polygon for each test, constructed upon the same paper for easier comparison, shows that health knowledge possessed is greater than that put into practice, according to the pupils' scores on the two questionnaires. (See Fig. XXXIV). In these polygons, cases are grouped into class-intervals of five, on the marking scale of 100. A histogram of all cases in each test grouped into class-intervals of ten, shows in another way that health habits, as measured by the health questionnaires, lag behind health knowledge. It is noteworthy that, in all these means of comparison the health knowledge scores do not exceed the health habit scores by more than 11 points, and that they correspond, in a general way, within this range. (See Fig. XXXV).

As a final indication as to whether or not there is any relationship between health habits and health knowledge measured by these health questionnaires, a
Figure XXIV

Frequency polygons of all scores, test 1 (blue) and test 2 (red).
Histogram of all scores test 1 (blue) and test 2 (red).
Class-interval of IC.
correlation was made between all the scores on the health habit questionnaires, and all the scores on the health knowledge questionnaires. This correlation (.24 ±.02) was not very high, but judging by Monroe's standard of a 4 to 1 ratio between coefficient of correlation and probable error, we may consider that this shows a definite positive relationship between health knowledge and habits. However, we should not expect the coefficient of correlation to be very high when it may be seen from the various frequency curves that habit scores are always lower than knowledge scores. The fact that we have not a negative correlation, but a slight positive relationship, should be noted.
PART III
DISCUSSION

Health Habits Inferior to Health Knowledge

It is significant, in comparing scores grouped by towns, that in no case do we find an average knowledge score lower than an average habit score. In Figure I, we find that the mean of the scores on the health knowledge questionnaire is always greater than the corresponding mean for the health habit questionnaire. Moreover, the modes (Fig. II) of the ungrouped scores on the knowledge questionnaire are, in each case, higher than the modes on the habit questionnaire, as are also the modes of the frequency polygons (Fig. X) in which scores are grouped in class-intervals of five points. The medians, too, (Fig. III) show a balance in favor of the knowledge test scores, in every case. Furthermore, on all of the frequency polygons of scores obtained by pupils of each town (Figs. V-VIII), the red figure, representing the knowledge questionnaire, shows its scores to be above those of the blue polygon representing habit scores.

According to Figure V it would appear that one exception must be made to the inference that health knowledge is always higher than habits indicate. However, the low score was obtained on a questionnaire on which only
a few questions were answered. (See below). Since results of such questionnaires were not discarded and since there was no indication of unusual circumstances interfering, on the questionnaire having the low score, this case had to be considered with the others. Nevertheless, it is highly probable that some other factor entered here, making it impossible for the pupil to answer even all the questions he knew, so this exception does not invalidate the general theory.

In the comparison of data for boys and girls, Figures XIII and XIV show that when all scores are considered, results of test #2 are all higher than the scores on test #1, with the exception of T2, Figure XIII. In this case, boys of T2 appear to have better health habits than their knowledge would indicate. However, on investigation of the original questionnaires, we find that, in test #1 there were three cases in which there were several unanswered questions, but that in test #2 there were thirteen cases in which several questions were unanswered. Since there was no time limit for these tests, it was necessary to assume, in all cases, that when questions were unanswered the pupil did not know the answer, and questionnaires containing unanswered questions were not discarded. Even assuming that, in every case but one the questions were unanswered because the answers
were not known, if in one case the low score was due to some unknown factor which limited the pupil's time and did not allow him to answer all the questions, this would explain the slight difference (.1) between knowledge and habit scores. When the scores of all boys for all towns, and of all girls for all towns were combined in Figure XV the means of scores for each sex were higher on the habit questionnaire than they were on the knowledge questionnaire.

Considering, now, the scores grouped according to whether or not pupils have studied biology or hygiene in high school, Figure XXVII shows that, among pupils who have studied these subjects, the scores on test #2 are all higher than those on test #1, with the exception of T2. Figure XXIX shows that, among pupils who have not studied biology or hygiene, the knowledge scores are all higher than the habit scores. Since this exception occurs in only one town, and since, for the same town, the group which did not study these subjects has an abnormally high score on the knowledge questionnaire, which would make the average for the town higher in knowledge than habit scores, we may consider that some factor in the group caused the knowledge to be exceeded .3 points by the habit scores.
Among the ungrouped scores, the mean health habit score is lower than the knowledge score, whether the statistical average is in the form of the mean (page 65), median (page 66), or the modes of the frequency polygons (Fig. XXXIV). With the frequency polygon made from the scores grouped in class-intervals of five points, and the histogram, grouped in class-intervals of ten points (Figs. XXXIV and XXXV) we also find that knowledge score to be higher than the habit score.

The fact that knowledge scores are higher than habit scores when pupils are grouped according to the towns in which they attend school, according to sex, ungrouped, or, with one exception, when grouped according to whether or not they have studied biology or hygiene in high school, shows that, under the conditions of this study, health knowledge, as measured by the health questionnaire, is always superior to the actual practice of health procedure as measured by the habit questionnaire. It indicates that knowledge is an accompaniment of effective health habit training in the class of students examined, and that a child does not form a good habit, but he may form a bad habit without knowing that it is bad, or he may form a bad habit while knowing that it is not a good habit. This signifies that reliable health
training is always valuable, since it calls attention to bad habits and makes possible good health habits, even if it does not always result in them.

Health habits influenced by health knowledge

Investigation of Figures I, III, and X, shows that the variations between the scores on the habit questionnaire and the knowledge questionnaire ranges from 0 to 8.5 in Figure I, 5 to 10 in Figure III, and 1 to 9 in Figure X but that, in none of these cases does it exceed eleven points on the percentage scale used for scoring.

As was noted in Part II, section I, page 31 variation in modes is great, and there are double and triple modes. The abnormally large variation in T1 in test #1 Figure II, may be explained, to some extent, by the fact that these are modes of ungrouped scores in a small number of cases (55). Since scores were entirely ungrouped, we find the largest number of cases (only 4) occurring at 63, but if even the whole and half numbers had been grouped we would have found an equal number of cases (6) at 72 and 72 1/2, as well as at 63 and 63 1/2. The large range of scores (from 51 1/2 to 91 1/2) caused such scanty distribution that the mode is a rather unsatisfactory measure of the average. Then, too, we
have the triple mode in T1, test #2 (Fig. II). Theoretically, these should not occur, but actually the small number of cases, the wide distribution, and the similar experiences of pupils of a single school, in a single community, may well account for such a triple mode. These modes occurred at points where there were five cases.

However, the two double modes, T3 and T4, test #2, can not be explained on the basis of the small number of cases, for in each instance there are over 100 cases, and the range of distribution, though large, was not abnormal. In T3 we find approximately an equal number of cases at all score points, from 75 to 82, and it so happens that two points, 75 and 78 each have the largest number of cases (10). In T4 the same situation obtains from scores 77 to 85, with the two points 82 and 85 each having the largest number of cases (9). If cases were grouped as is customary in obtaining certain modes, we could find, in both towns that the high points would be represented in the mode at the class-interval containing the ten points of score, 75 to 85. Since a difference in score of only 1/2 can change the position in the ranking order of a score, it is not unreasonable for two scores as close together as 75 and 78 or 80 and 82 to have an equal number of occurrences when considering 100 to 150 cases. The higher amount of variation between the two
tests may be due to a possibility that the variation is really greater than that suggested by consideration of the arithmetical means, but since the mode of ungrouped scores is such an unsatisfactory measure of average in a small number of cases with wide distribution, it appears more probable that the degree of variation indicated by the mean is nearer the true one, and that the mode is not a very valid measure of the amount of difference between the two sets of scores. The above conclusions may also be applied to the variations (10 and 14) between different towns in the two tests.

On the polygons for each town, also, there is no separation of more than 11 points between the lines of the red (knowledge) and the blue (habit) polygons. Figures XIII, XIV, and XV, where pupils are grouped according to sex, show variations between the health knowledge and health habit questionnaire scores ranging from .5 to 8 in Figure XIII, -.1 to 9.2 in Figure XIV, and 2.8 to 4.0 in Figure XV, but that here again, the difference does not exceed 11 points on the percentage scale, in any case.

When pupils are grouped according to whether or not they have studied biology or hygiene in high school, as in figures XXVIII and XXIX we find variations between
the health habit and the health knowledge questionnaires ranging from -0.2 to 7.6 in Figure XXVIII, and from 3.3 to 10.9 in Figure XXIX. Here also there is no variation greater than 11 points.

The polygons (Figs. XXXII and XXXIII) and histograms (Figs. XXX and XXXI) show that when all towns are combined, there is no difference of more than 11 points in scores on habit and knowledge questionnaires even when pupils are grouped according to whether or not they have studied biology or hygiene in high school.

Among ungrouped scores, there is no difference exceeding 11 points in either the mean (page 65), or the median (page 66) between the knowledge and questionnaire scores. Similarly the histograms of scores grouped into class-intervals of ten (Fig. XXXV), and the frequency polygon of scores grouped into class-intervals of five, show no points, even at the modes, at which there is a difference of more than 11 points.

Therefore, when scores are grouped according to the towns (with the exception of the modes), according to sex of pupils, according to whether or not pupils have studied biology or hygiene in high school, and even when they are ungrouped, the score on the health knowl-
Knowledge questionnaire is never more than 11 points higher than the score on the health habit questionnaire. This means that, though the pupil's health habits were never better than his health knowledge, (see page 66) yet his knowledge of good health practices, however high in score, was never much higher (more than 11 points) than his health habits. If there were no relationship between health habits and health knowledge, as measured in this study, we should expect to find several groups, in which knowledge of health scored very much higher than the practice of good health habits, but such is not the case, here. If there were not a positive relationship, we should expect to find several instances in which the knowledge scores would be decidedly less than the health habit score. Since all scores are higher, for knowledge than for habits, but are never more than 11 points higher, logically, if these questionnaires are true measures of health knowledge and habits, health habits may be considered to influence health habits, so that they correspond within 11 points of a percentage scale.

Taking a coefficient of .30 as an arbitrary standard of positive correlation, according to the coefficients of correlation (Fig. 9) between the scores received by each pupil in each town on both tests, it would appear that T2 is the only town in which there is any
relationship between health habits and health knowledge as measured by the questionnaires. Even judging positiveness of correlation by the ratio between the probable error and the coefficient of correlation, on only three towns (T2, T3 and T5) is there a definite positive relationship. It is true that these are the only cases in which the correspondence, between the individual cases in actual scores is marked, but the contention of this thesis is not that the habit score is the same as the knowledge score, but that it is always lower, yet does not vary unduly from it. This means that the knowledge score may be anywhere within a range of 11 points above the habit score, and still indicate that there is some slight relationship, since it never varies more than that amount, and is never lower than the habit questionnaire score. Such a relationship might be indicated by the fact that the correlation is not negative, but would not necessarily be shown as a definite positive correlation.

Since, when scores are grouped according to towns, sex, study of biology or hygiene, and ungrouped, the difference between health habit and health knowledge scores indicate a positive relationship between knowledge and habits of health, and since correlations do not con-
trivial, and possibly do indicate, such a relationship, we conclude that, under the conditions of this study, it is indicated that health knowledge does influence health habits, so that a larger amount of reliable health knowledge is accompanied by improvement in health habits.

Influence of environmental factors on relationship

Since a slight positive relationship between health habits and health knowledge is indicated, it is desirable to know how certain factors influence such a relationship. Figures I and III indicate that there are differences, from town to town, in the variation between health habits and knowledge as measured by the questionnaire scores. There is a range from 0 to 8.5 in the differences between scores in Figure I and from 1 to 9.0 in Figure III. However, the greatest variation between the averages of the habit questionnaires from town to town is low (2.5), whereas the greatest difference between the averages of the knowledge questionnaires from town to town is higher, (9.0).

There is a still greater variation from town to town, in the difference, ranging from 7.5 to 20, between modes or ungrouped scores on test #1 and test #2 (Fig. II). Also, the variation between modes among
habit questionnaires is large (14), as is the variation among knowledge questionnaires (10). Here, the variation is greater on the habit questionnaire than on the knowledge questionnaire. Because these modes covering wide distribution of ungrouped cases are not very representative of true averages (see page 73) conclusions which the means, medians, and other data indicate, need not be greatly modified by the contradictory evidence of these modes. Furthermore, modes of the frequency polygons (Fig. X) show a difference in variation between health knowledge and health habit questionnaires from town to town of only one class-interval (5 points), and the variation from town to town is greater (10 points) for the knowledge questionnaire than for the habit questionnaire (5 points).

A part of the lack of correspondence between habit and knowledge polygons for T may be due to the fact that practically all children of the class have the same opportunities for learning about good health practices through their school classes, Boy and Girl Scouts, radios, district nurse and other health education agencies, but a considerable number of the pupils are unable to practice all the good health procedures which they know about, because of the living conditions in the rural districts. Many of the children are unable to get proper
sleep in summer because they work on the onion and tobacco farms from early until late. Also one girl replied in answer to the question about bathing, that there was no bathtub in her home. Others bathed infrequently because of the difficulty of heating water enough for baths for a large family on a kitchen stove. Such factors make it impossible for the pupil to do as well as he knows he should.

The evidence from the above data indicates that, in general, there is greater variation in scores on the knowledge questionnaire than in scores on the habit questionnaire. Habits of health, as measured by the questionnaire, appear to be quite uniform throughout all the towns, whereas knowledge, as measured by test 23 is more variable, indicating that knowledge is influenced more by environmental factors than habits are. Reciprocally, this suggests that health habits are formed by factors which are more constant under varying environmental conditions of different Connecticut Valley towns, than are the factors influencing acquisition of information concerning health. Health habits are learned, to some extent, by imitation. Folkways or conventionalities which are widespread throughout New England, at least, and are known and practiced by all the native parents, and
quickly acquired by even foreign-born parents in their attempts to adapt themselves in this country assist, to some extent, in the formation of similar health habits of the children. Another group of habits is influenced by public health legislation. For example, smallpox vaccination is a health practice which is common to practically all school children in the towns investigated, because there is a state law in Massachusetts requiring vaccination. Knowledge concerning the reason for this practice, or even any understanding of it, however, depends upon health education, and a large proportion of the high school pupils showed by their replies that they had very little idea as to its purpose. Some factors which teach health knowledge equally affect all the towns. This may be illustrated by the radio, which is very effective, yet is common in every town. A very large majority of the pupils, in response to the question as to the care of teeth said, "Brush them twice a day, and see a dentist twice a year", and many added, "Quote Amos and Andy". The radio is also teaching some practices harmful to health, for many pupils, in answer to the question as to whether or not a high school pupil should smoke, answered, "It is all right to smoke Lucky Strikes, they are kind to the throat". However, good teachers, especially fine Boy
and Girl Scout leaders, or public health nurses would affect only the pupils from one community, and probably only a certain group within the community. These leaders can improve the health knowledge only in the towns where they do their work. Another factor which might influence the health knowledge of pupils, yet would be variable from town to town, would be the biology, hygiene, and physical education classes. (See Part II, Section III). These educational factors are important in improving health knowledge. If habits do not lag behind knowledge more than 11 points, as has been suggested, it is important that health knowledge be improved by making use of all the available educational material, in order to increase the transfer from knowledge to habit. Accordingly, this study indicates that environmental factors which vary from town to town, influence the relationship between health knowledge and health habits of the pupils of the Junior classes of the high schools in the several towns, by increasing the variability in health knowledge from town to town, while the health habits, less influenced by environment, remain more constant throughout all the schools.

Influence of sex on relationship between health knowledge and health habits.
It is desirable to know how sex influences the slight positive relationship, indicated by this investigation, between health knowledge and health habits of the high school pupils in these Connecticut Valley towns. Figure XV, which compares the mean combined scores of boys and girls on both questionnaires, points out that when ungrouped, there is greater difference between the health habit and health knowledge scores for girls (4) than there is for boys (2.8). In other words, the relationship between health knowledge and habits varies according to the sex of the pupil. There is more difference, however, between the scores of the boys and those of the girls on the knowledge questionnaire (3.6) than there is between the scores of the two sexes on the habit questionnaire, (2.8). This difference, though slight, indicates that the sex of the pupils influences his knowledge more than it affects his habits. If this is so, it follows that a pupil's sex affects the relationship between health knowledge and health habits by varying the knowledge more than habits. Knowledge is changed chiefly by teaching, so it is probable that the differences in knowledge of the two sexes is due to differences in teaching or learning, and are only indirectly due to physiological and psychological qualities.
of boys and girls.

Influence of sex on knowledge and habits of health

Moreover, though knowledge scores are higher than habit scores for both boys and girls, the greater difference between the two among girls than boys, suggests that boys come nearer living according to the best standards of health which they know, than do girls. The scores indicate, also, that boys' health habits are not as good as girls' habits, and that boys' health knowledge is not as great as girls' knowledge.

All these factors indicate that the differences between the two sexes in matters of health are due less to physiological or psychological differences of boys and girls than to the variations in training and environment which boys and girls have. Thus, the results of this study point out that the sex of a pupil affects his health knowledge and habits chiefly by determining, to some extent, what subjects he shall study in school, what he shall learn informally, his attitude toward his knowledge, and what shall be considered conventional for him to do.

It has commonly been assumed that the health habits and health knowledge of girls are better than those of boys. In order to discover whether or not this
is true, mean scores of boys and girls on the health questionnaire were compared when grouped according to towns, according to whether or not they studied biology or hygiene in high school, and ungrouped. Girls' habit scores were higher than boys' scores in all towns, when scores were ungrouped (Fig. XX). When boys and girls were grouped as to whether or not they studied biology or hygiene, habit scores of girls who did not study biology were higher than those of boys who did not study these subjects (Fig. XIX). This indicates that when neither group has been "exposed" to health teaching in school classes of biology or hygiene, the girls naturally have better habits than boys, according to the questionnaires used in this study. Several causes may be suggested. Once cause may be that the girl has greater opportunity for accumulating health hints which she follows in order to be attractive. The boy of this age, scorning beauty as a feminine trait, does not pay any attention to the forms of health teaching which set beauty as their goal. The average girl of high school age also reads more than her boy classmate, and from her reading she gleans some health facts which she applies in her daily conduct. It is probable that the sex only affects health habits indirectly, by varying the training, and the ideals set before the pupil, in matters of health.
Health knowledge scores, when grouped according to towns, were better for girls in all cases, except Tl, Figure XXI. Knowledge scores for those who studied biology or hygiene, are higher in all cases, for girls than for boys, but among those who did not study these subjects, we find that the girls of Tl are again an exception. It is difficult to understand why the boys of Tl should have higher knowledge scores than the girls for Tl, for the girls receive more health teaching in their physical education classes, and in a course in Home Economics. The Girl Scout organization is also fully as active as the Boy Scout organization, and its teaching is in favor of the girls. Even the living standards of the families from which boys and girls come are approximately the same in this town, as far as general observation indicates. It is possible that boys have listened to the radio health talks and profited by them more than girls have. However, the writer visited some classes in biology when these pupils were Sophomores, and was impressed by the relative lack of interest of the girls of this group, and this lack of interest may explain why the girls did not derive more benefit from the biology course.

These data indicate that, in general, the popular assumption that girls' health habits are better than those
of boys, is based on facts when neither boys nor girls have had health training in biology or hygiene in high school. However, when boys and girls have had much training, the habits are approximately the same for boys and girls, and the knowledge of girls is greater than that of boys, as measured with the health knowledge questionnaire. Since a smaller amount of knowledge, for boys, produces equally as good habits as a larger amount of knowledge brings about in girls, we may conclude, logically, that boys who have studied biology or hygiene apply their knowledge better than girls do.

Influence of study of biology or hygiene on relationship

The scores of pupils who studied biology or hygiene in high school were compared with those of pupils who did not study these subjects, in order to show how study of biology or hygiene influences health knowledge and health habits, and the relationship between them.

When the scores on the health habit questionnaire of all those who studied biology or hygiene were compared with scores on the habit questionnaire of all pupils who did not study either of these subjects, two towns were found to have better average scores for those who did not receive biological teaching than for those
who did. Groups of boys received higher scores after study of biology or hygiene than if they did not study these subjects, in all but one town, yet girls in four towns received higher scores if they did not study these biological subjects. Considering health knowledge, it may be noted that in ungrouped cases, in groups of boys only, and in groups of girls only, there are nearly as many instances in which scores of those who did not study biology or hygiene are higher than scores of those who did study these subjects as there are of the reciprocal relationship. The differences, also, are not great in any case except T2 Figure XXVII. The great variability denotes that according to the conditions of this investigation, the study of biology and hygiene in the schools tested does not positively influence health knowledge to any extent measureable by the health questionnaires.

In general, health habits were improved by courses in biology or hygiene, for boys. For girls, however, habits were usually not better after study of these subjects. Since boys who have not studied biology or hygiene in high school have higher scores than boys who have not studied them, and since girls' scores are just as high as before studying these courses, it may be that girls' health habits are as good as they can be without special habit training, (which is seldom a part of biology
or hygiene courses). It may be, also, that the courses in biology and hygiene are now so taught as to cause boys to apply what they learn, but not so taught that they appeal practically to girls, since we have seen that boys profit more, in improved health habits, if they study these subjects than do girls.

Since we find a range from -.3 to 7.6 (7.9 points) in the difference between health knowledge and habit scores when all the scores of pupils who studied biology or hygiene in high school are combined, and a range of 3.3 to 10.4 (7.1 points) between the two tests when pupils have not studied these subjects, it seems that the relationship of health habits to knowledge does not vary much from town to town, after study of biology or hygiene. The fact that these differences are smaller where pupils have studied these subjects, however, suggests that there is a relationship, which is a little closer for those pupils who have studied biological subjects, when all scores are combined.

Application in educational field

During the course of this study, certain facts have been indicated as true of the pupils in the Junior classes of certain Connecticut Valley high schools according to the measurement by health knowledge and
and health habit questionnaires under the conditions of this investigation. Since these pupils represent practically all of the group studied, with the errors of sampling reduced to a minimum, and since the communities studied are fairly representative of Connecticut Valley towns, if the measurement is valid, the facts brought out ought to be applicable to all pupils in high schools of the Connecticut Valley, and may indicate tendencies among high school pupils in general.

Moreover, knowledge of these facts suggests certain educational implications and applications.

We note first, the strong indication that health knowledge is always superior to health habits. Data referred to above (Part III, page 69 to 73) show that the health knowledge, as measured and scored with test #2 is greater in amount than the knowledge applied in health habits, as measured by test #1. According to the scores on questionnaires, the habits may be as much as 11 points on a percentage scale lower than the knowledge of the same pupil. Since, sometimes, the scores closely correspond, it must be possible for habits to nearly reach the standards known. The town in which a pupil lives, and his sex, influence his habits, but both of these bring their influence to bear chiefly through education. If health behavior can be as high as the
standards known, it is the duty of the educator to see that it approaches this ideal state as nearly as possible. In order to make health habits better we must increase transfer from knowledge to habits.

This may be done by using more interesting and impressive methods of health teaching. We have seen that "Amos and Andy", over the radio, have penetrated nearly every home, and by daily repetition of their message, combined with other material interest of great interest to children, made the slogan "Brush your teeth twice a day, see a dentist twice a year", well known through all the towns investigated. The great success of this suggests that, by the same method, the radio might well be used for other phases of health education. It might also be used, through contests and clubs, to improve health habits, as the "Safety Crusaders" are trying to improve safety habits.

Transfer may also be increased by more systematic checks on the results of health education, such as are afforded by the medical examination, the height-age-weight scale, daily inspections, self-scoring cards, decrease in number of absences, and correction of physical defects. If such checks are used, results must be shown and interpreted to the pupil in order to stimulate interest and endeavor.
Transfer from health knowledge to health habits may be increased within the school by more interesting courses in health, by teachers who have, themselves, positive health, and by teachers who know how to correlate health teaching and activities with all the other lessons and activities, and have the patience to carry out thoroughly the checks such as inspections and contest in habit scores. As W. W. Davis says, "The making of posters, weighing and measuring, the health clown, the health plays competitive health games, all make a direct appeal to the child. More instruction, the health talk, is of little use."1

That health knowledge does appear positively to influence health habits is of educational value, because it justifies teaching health in high schools, even as it is now taught, and because it implies there should be some method of health teaching in every school, in order to keep the health of the school child in the best of condition, and provide a generation of health-educated parents for the pupils of the future schools.

The fact indicated, that environmental factors influence health knowledge in varying amounts from town to town, but influence habits very little, means that

more should be done to try to improve health habits. This implies that each town should use all the educational factors at hand to make health knowledge widespread so it can influence habits, but also, that there needs to be health habit training as such. The factors which vary most from town are the school teachers, the public health nurses, the courses of study in health work, opportunities for practice of good health habits, and the parents. The factors, among these, which are being least improved, in the Connecticut Valley, are the last two, which are really phases of the same one, the parents. As W. W. Davis says, "The parent is the greatest factor in the formation of health habits, good and bad." Parent education is greatly needed if habits of health are to be really improved, for the school can make little progress against the constant ridicule of parents. If parents realize the importance of good habits on the future, and even the present child health, they will make more effective attempts to make the environment such that it will be possible for the child to practice good health habits. Work late at night for the school child will be decreased if not eliminated, and an attempt, at least, will be made, to provide opportunities for frequent bathing. Most of all parent education would improve the

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food habits of school children, and the constant use of coffee, tobacco, and alcoholic liquors.

The study of the influence of sex on health habits and knowledge indicates that more time and effort should be spent in improving the health knowledge and habits of boys, since they appear to be behind girls in every way, yet it is indicated that when boys know what is right to do, they more nearly practice their ideals in the matters of health.

The indication that biology and hygiene courses in high school do not appreciably affect either health knowledge or habits, does not mean that the course is not very good for its kind, but does indicate that the school is not making the most of an excellent opportunity for correlation of health work with subject matter related to it.

The educational recommendations may be summed up as follows: (1) parent education in health, (2) increased health education for boys especially, (3) more use of such agencies as the radio, public health nurse, Scout organizations, and school teachers, (4) incorporation of more health teaching into biology and hygiene classes.
PART IV

CONCLUSIONS.

1. This investigation indicates that the pupils in the Junior classes of the high school of certain Connecticut Valley towns know more about good health procedures, according to the measurement by the health knowledge questionnaire, than they apply in their health habits, according to the measurement by the health habit questionnaire.

2. The health habit scores are never more than 11 points lower than the knowledge scores, according to the questionnaires.

3. This indicates that, though pupils always know more about health than they apply in their habits, habits do correspond with knowledge within a definite range (11 points on the questionnaire scores).

4. Such a correspondence may be called a positive relationship between knowledge and habits, under the conditions of this study.

5. The degree of this positive relationship is slightly influenced by sex, the smaller variation and consequently the greater relationship between knowledge and habits of boys.

6. The study of biology or hygiene in high
school appears to have very little affect on either knowledge or habits; or the relationship between them.

7. Since there is a slight positive relationship between knowledge and habits, increase in knowledge should bring about some improvement in habits.

Recommendations:

It is recommended that this increase in knowledge be brought about by more effective health teaching through a definite program of health education to be carried out by schools, clubs, and the radio. It is further recommended that the transfer from knowledge to habit be increased, by systematic checks in the school upon health habits, and by parental education in health practices for the purpose of making possible a definite transfer of the knowledge possessed by pupils.
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Approved by

[Signature]

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Committee on Thesis.

Date ______________