

An Assessment of Health Hazard/Health Risk Appraisal

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Abstract: A state-of-the-art review of a widely-used health promotion technique, the health hazard/health risk appraisal (HHA/HRA), was conducted. The review included preparing a 212-item annotated bibliography, compiling an inventory of 217 programs that have used HHA/HRA, holding discussions with HHA/HRA developers and users, conducting formal site visits to 15 HHA/HRA programs, and consultation with experts in epidemiology, biostatistics, and behavioral science as well as developers and users of HHA/HRA.

Programs use HHA/HRA primarily as a promotional device, as a tool for structuring education about

health-related behaviors, and as a motivational device for stimulating behavioral change. The scientific basis for HHA/HRA risk predictions is problematic, but their arithmetic imprecision is of less concern than insufficiency of the scientific evidence for certain behavioral recommendations, and inaccuracies in client-supplied data. Widely-held beliefs in HHA/HRA's efficacy for motivating behavioral change cannot be substantiated from available evidence, nor can the assumed absence of adverse effects. The importance of this particular health promotion technique appears to have been exaggerated. (*Am J Public Health* 1982; 72:347-352.)

Introduction

Health Hazard/Health Risk Appraisal (HHA/HRA) is a health promotion technique in which an individual's health-related behaviors and personal characteristics are compared to mortality statistics and epidemiologic data^{1,2} in order to estimate his or her risk of dying by some specified future time along with the amount of that risk which could be eliminated by making appropriate behavioral changes. These measurements of risk and the potential benefits of behavioral changes are presented to the individual in order to stimulate his/her participation in activities aimed at changing life-style and improving health.

This technique has been widely adopted in recent years for a variety of reasons. First, it provides the health educator with a rationale and teaching aid to focus discussions of health and behavior. Second, it relies on self-administered questionnaires, simple physiologic measurements, and computer-assisted calculations, making its application to large

groups feasible, efficient, and relatively inexpensive. Third, it has all the trappings of modern science with reference to studies, precise numbers, and computer printed reports and is, therefore, consistent with the established values of many segments of American society. Fourth, it is consonant with current thinking and publicity about the role of life-style in disease etiology. Fifth, the data gathering devices, computer software, and other aspects of the program can be marketed as a package which has stimulated the involvement of commercial firms. Thus, there are strong cultural, political, and economic pressures for wider application of such an approach. The recent entry of large commercial firms into the marketing of HHA/HRA packages provides further evidence of the growing popularity and enthusiasm for this strategy.

Because of this increasing interest in HHA/HRA, it is timely to assess the contribution that HHA/HRA has made (or can make) to health promotion/disease prevention (HP/DP). In this atmosphere of enthusiasm, burgeoning use, yet lingering concerns, we have attempted to document the extent and manner in which HHA/HRA is being applied, as well as to review its scientific basis, efficacy, and effectiveness, through literature review, consultation, and the study of a limited number of currently operational programs.

More specifically, we sought some answers to the following questions:

1. How sound is the scientific basis for the assessment of individual risk and benefits of appropriate behavioral change?
2. How do programs measure individual health characteristics and to what extent do problems in measurement influence the acceptability and utility of HHA/HRA?

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3. How do programs compute risk and to what extent do various HHA/HRA approaches yield different risk and benefit assessments for clients with similar characteristics?

4. What are the settings in which HHA/HRA is being used and to what extent do the characteristics of the setting influence the success or failure of HHA/HRA?

5. What is the evidence supporting a positive effect of HHA/HRA on participation, knowledge, health-related behaviors, and morbidity and mortality?

6. What is the evidence of physical/psychological risk associated with HHA/HRA?

7. What is the acceptability, validity, and efficacy of HHA/HRA for less-advantaged social groups?

8. What are the major areas regarding HHA/HRA that are in need of further research?

Although many more questions were addressed, we consider these questions to be fundamental. This paper summarizes our approach to the questions and our best response to each.

Methods

Multiple approaches to information-gathering and review characterize the methods used. These include:

- literature review;
- compilation and review of an inventory of HHA/HRA instruments and programs;
- consultation with experts in epidemiology, biostatistics, and behavioral science as well as developers and users of HHA/HRA;
- epidemiologic and biostatistical review of risk estimation in HHA/HRA; and
- site visits to HHA/HRA programs.

Literature Review

Through formal library sources and personal communications, we attempted to identify and obtain all published and unpublished documents pertaining to HHA/HRA or related issues in HP/DP. Two hundred twelve books, articles, reports, theses, and speeches were critically reviewed and annotated.³

Inventory of HHA/HRA Instruments and Programs

We attempted to identify and catalogue HHA/HRA instruments and programs in the following manner. First, all extant suppliers of instruments or services, both public and private, were contacted and requested to supply us with sample instruments and a list of active clients. All responded with sample instruments and with a list of clients which varied considerably in size and, we think, in completeness. These lists were supplemented with programs known to us through the literature review and personal contacts. By these means, 217 programs were identified and contacted by letter and occasionally by telephone. Each program was asked for the following information: location, sponsorship, HHA/HRA instrument used, year of program initiation, number of HHA/HRAs performed, important client groups,

risk reduction services provided, fee charged for HHA/HRA, and availability of evaluation data.⁴

Expert Panel

In an effort to obtain continuing input from individuals knowledgeable in various issues of importance to the assessment of HHA/HRA, a panel was convened consisting of experts in the fields of epidemiology, biostatistics, health education, communications, cost-benefit analysis, and health policy. Each member of the panel was interviewed individually and participated in a two-day conference. The input of the expert panel was supplemented by additional consultations with important figures in the development of HHA/HRA as well as other authorities in health education, epidemiology, and biostatistics.

Epidemiologic and Biostatistical Review

In consultation with relevant members of the expert panel and others, we systematically reviewed the content of HHA/HRA data-gathering instruments, the health characteristics considered in HHA/HRA programs, and the major epidemiologic studies from which HHA/HRA developers derived the statistics upon which HHA/HRA depends. Our review included relevant biometric literature and simulation of HHA/HRA results for hypothetical clients.⁵

Site Visits

From the inventory of known HHA/HRA programs, 15 programs were visited by a team consisting of two or three members. In order to emphasize stable and substantive programs, we generally restricted our purview to programs which had administered at least 300 HHA/HRAs in the previous year. Exceptions were made for programs using innovative approaches, conducting major evaluations, or serving minority or low-income clients. These were given priority for site visits. The programs we visited, in the aggregate, used a full range of available HHA/HRA instruments in a variety of settings, with a broad range of risk reduction services. Site visits were conducted over a one- to two-day period using a structured protocol. We interviewed both program staff and managers in the sponsoring institution(s) responsible for the program's current and future position within the institution.

Results and Discussion

1. *How sound is the scientific basis for the assessment of individual risk and benefits of appropriate behavioral changes?*

HHA/HRA begins with the measurement, mostly by self-report questionnaire, of the client's behaviors and personal characteristics (e.g., smoking habits, alcohol intake, family history of cancer and heart disease, amount of exercise, frequency of physical check-ups for Pap smears, and breast examinations) viewed as predictive of an increased or decreased chance of dying from one of the leading causes of death. Each client response is assigned a numerical

value called a risk factor which serves as a multiplier of the average risk of dying within 10 years for each major cause of death to which the behavior relates (e.g., a two pack/day smoking habit doubles the average risk of dying from lung cancer in a 45-year old client). These average risks, presented as the number of deaths among 100,000 people, are calculated from national mortality statistics and organized by cause of death (usually the 10 leading causes plus an "other" category) for groups defined by age in five-year bands, race as Black or White, and sex.

When there are multiple risk factors for the same cause of death, their respective numerical values are combined by a simple formula to yield a composite risk factor which serves as the multiplier of the average risk of dying for that cause of death. Multiplying the composite risk factor times the average risk of dying gives a risk projection which could be higher or lower than the average risk, depending on the client's health characteristics. These risk projections are carried out for each of the ten leading causes of death and summed with average risk for "other causes" to arrive at a total projected risk of death. The result is contrasted with the average total risk. The comparison is usually expressed in terms of life expectancy or risk age, the latter being the age of an average person who has the same total risk of death. Recalculation of the total mortality risk using new risk factors based on maximal improvements in health-related behaviors produces a new result, called the achievable or compliance age.

Nearly every step in this sequence has been criticized and found to be wanting in terms of its effect on the accuracy of the prediction that results.⁶⁻⁹ But arithmetic precision is not of primary importance to the objectives of HHA/HRA or HP/DP in general. Much more important considerations are the scientific validity, credibility, and value of the message received by the client. In these respects, most HHA/HRA programs have had to overreach the extent of existing scientific knowledge in order to accomplish their aim of a comprehensive risk projection although the projections appear reasonably accurate. There are, however, several areas of concern.

First, the health characteristics measured and analyzed in the standard HHA/HRA include: a) behaviors for which the scientific evidence of their predictive importance remains controversial (e.g., exercise habits for death from coronary heart disease); b) characteristics for which the scientific evidence that intervention is efficacious remain controversial (e.g., reductions in cholesterol for death from coronary heart disease); and c) characteristics about which the client can do nothing (e.g., family history of breast cancer).

Second, many of the risk factor values are based on extrapolations of various kinds from data derived from two major epidemiologic investigations: the Framingham Heart Disease Study¹⁰⁻¹¹ and the American Cancer Society Study.¹²⁻¹⁴ These studies largely involve middle-aged, middle-class, White subjects, yet their findings are being used to predict the risk of Blacks, Hispanics, Native Americans, teenagers and other dissimilar groups. In a few cases, these extrapolations produce nonsensical risk factor values.

Third, there may be serious difficulties with the message generated for the younger client. Since most of the risk factor values represent extrapolations from studies of older individuals, many of the estimates may be grossly in error. Furthermore, the 10-year risk of death rises very slowly among individuals under the age of 35, so that small changes in total risk translate into dramatic alterations in risk age. Given these considerations, plus the frequently noted lack of salience to young people of their long-term mortality prospects, the use of the standard HHA/HRA among young people is in our view highly questionable.

Fourth, the specification and quantification of risk factors for some causes of death (e.g., homicide and suicide) cannot be substantiated, given the scarcity of epidemiologic studies in these areas.

2. How do programs measure individual health characteristics and to what extent do problems in measurement influence the acceptability and utility of HHA/HRA?

The manner in which the client's health characteristics are measured and recorded by HHA/HRA programs varies widely. In particular, physiologic measurements like blood pressure are often carried out by minimally trained personnel, with little consideration given to the accuracy of the measurement. At the one program we visited which had compared its cholesterol measurements to a standard, laboratory analyses of cholesterol levels were found to be systematically in error by 30 mg/dl. Perhaps even more problematic is the practice of asking clients to write in their own blood pressure or cholesterol levels instead of measuring them; if the client does not write in a value, an average value is inserted.

Since HHA/HRA programs seldom view the arithmetic precision of the risk prediction as very important, we heard few concerns expressed by programs about the quality of their client data. This lack of concern may not be justified as recent studies have indicated that clients can give very different answers to the same HHA/HRA questions when administered as little as three or four weeks apart, even for items which could not change.¹⁵⁻¹⁷ For middle-aged and older clients, an error of 20 per cent or more in the blood pressure level can create an error of several years in the risk age computation. Research on the quality of client data and its effect on the health promotion message has only barely begun; much more evidence would be needed to answer this question more definitively.

3. How do programs compute risk and to what extent do various HHA/HRA approaches yield different risk and benefit assessments for clients with similar characteristics?

Although many programs have altered the way in which risk-related information is presented to the client, the actual computational strategy used to estimate risk and achievable risk reduction has seen only limited experimentation. Few vendors or programs have added new health characteristics to the risk computation although some measure characteristics such as Type A behavior pattern or high density lipoprotein cholesterol and provide separate feedback concerning those factors. Some programs have developed simplified computational approaches using a limited number of risk characteristics and providing feedback in the form of a

“risk score.” The risk score, often based on a perfect score of 100, can free the program from constraints involved in the mortality prediction framework. These risk score applications are at the fringe of what is generally regarded as HHA/HRA. Whether their simplicity of computation and avoidance of risk ages and other life expectancy-oriented feedback makes them either more or less efficacious than the conventional HHA/HRA approach remains to be determined.

4. *What are the settings in which HHA/HRA is being used and to what extent do the characteristics of the setting influence the success or failure of HHA/HRA?*

Programs conducted in the workplace constituted nearly one-half of the programs identified in our inventory. Programs offering services to the general public, most commonly located in health departments, comprised the next largest group, followed by programs designed for college students and the patients of medical care organizations. Most programs served fewer than 200 clients in 1979 and nearly one-fourth administered fewer than 50 HHA/HRAs in that year. Related to the small size of most programs is the fact that the vast majority first provided services in 1979 or 1980 indicating the recency of the growth in use of HHA/HRA. Approximately one-half of the identified programs provided services on company time. The programs which charged for the administration of HHA/HRA and the provision of feedback received from \$10 to \$35 from each client, exclusive of additional charges for risk reduction services. The variation in the fees reflects primarily the complexity and comprehensiveness of the client information gathered, particularly the extent of laboratory testing done, but also the elegance of the report give to the client. Such reports varied from a single page summary to a multi-color personalized book.

Most programs reported providing counseling and risk reduction services. Counseling ranged from an extensive personal discussion of the results with a physician, nurse, or health educator to a large group discussion. Less variation in risk reduction services was encountered. These services generally consisted of small group meetings either provided by or patterned after well-known programs such as Weight Watchers, Smokenders, and the YMCA exercise programs.

Although we intentionally chose to visit programs that were larger, more innovative, and better evaluated than most of the programs in the inventory, we nevertheless encountered wide and important variation in the reasons for using HHA/HRA and in what it was hoped the technique would accomplish. The often differing conceptions of HHA/HRA as expressed by the sponsoring agencies and by the programs ranged from the view of HHA/HRA as a convenient and attractive tool with which to collect client data or attract attention to the view of HHA/HRA as a powerful motivational stimulus for health behavior change leading to reduction in illness and health care costs. Several industry managers related their interest in HHA/HRA to their concerns about the cost of health care benefits and indicated that their continued interest would be dependent upon the effect of HHA/HRA in reducing health insurance claims.

Definitive evidence supporting HHA/HRA success in changing behaviors or improving health is currently unavailable. Programs' success in establishing themselves as meaningful and stable parts of their sponsoring institutions varied. Factors associated with this sort of success related principally to the depth of commitment of the sponsoring institution to promote health-related behavior change among its workers, students, or clients. Our impression is that programs integrated into an ongoing health or medical service, such as a medical practice or an employee health or assistance service, seemed to be the most stable and efficient. Whether these integral programs produce the greatest positive impact on clients remains to be demonstrated.

5. *What is the evidence supporting a positive effect of HHA/HRA on participation, knowledge, health-related behaviors, morbidity, and mortality?*

The enthusiasm for HHA/HRA has been fueled by anecdotal reports of its effectiveness in increasing participation in health promotion programs and in motivating behavioral change. Several uncontrolled studies have strengthened the belief in the technique's effectiveness. Methodologic problems in studying behavioral change—volunteer bias, secular change in the public at large, the absence of a comparison group, and measurement unreliability—severely limit the scientific validity of these studies. Of three randomized controlled studies that have been reported, one found no impact on attitudes toward disease susceptibility,¹⁸ and a second found no impact on health-related behaviors.¹⁹

The third, and most elaborate, found numerous behavior changes in the HHA/HRA groups compared to the control group²⁰ but its findings can be viewed only as suggestive. In this experiment, Lauzon randomly allocated 346 Canadian government workers to three groups: an “attention control group” not receiving HHA/HRA, a group receiving only HHA/HRA results and interpretation, and a group receiving HHA/HRA and personal health counseling. Follow-up information was obtained three months after intervention regarding 11 dependent variables including appraised age, blood pressure, several health related behaviors, and anxiety levels. The multiple outcomes each were examined within eight age-sex-risk subgroups and any *p*-value less than .05 labeled as “significant.” The multiple comparisons yielded several apparently positive effects of HHA/HRA but these were generally small and inconsistently distributed among the subgroups.

Effects on knowledge, although more easily studied, have received little attention. Several well-designed controlled trials will soon provide better evidence in the area of health knowledge and behaviors. Morbidity and mortality are unlikely to show an influence in the short duration of any studies underway or planned.

6. *What is the evidence of physical/psychological risk associated with HHA/HRA?*

Risk to clients has received little systematic attention and, in our experience, is not viewed as a significant possibility by most workers in the field. One study found no difference in state or trait anxiety scores between groups that received HHA/HRA feedback and a group that did not.²⁰ However, we did hear anecdotal reports of depressive

responses to life expectancy predictions among older clients. Many possible adverse effects, such as anxiety, depression, hypochondriasis, unnecessary medical expenses, and confusion or even harm from misinformation, could result from health promotion programs including those using HHA/HRA. Overemphasis on personal health habits and the responsibility of the individual may foster a compulsive and distorted understanding of health and disease, leading to guilt, intolerance, and mistakes. Investigation of possible risks from programs aimed at overall life-style change should receive serious consideration, regardless of whether they employ HHA/HRA. We view this as an important issue to be considered in planning future research.

7. *What is the acceptability, validity, and efficacy of HHA/HRA for less-advantaged social groups?*

HHA/HRA has been characterized as being most relevant for White middle-class clients. Our review and site visits found little to dispute this characterization. Epidemiologic data on most risk factor-disease relationships on non-Whites are sparse, so validity is uncertain. The question of whether HHA/HRA computations for Black clients should be based on Black mortality statistics remains unsettled in our view. The most consequential effect of using race-specific mortality rates as contrasted with total mortality rates is to highlight the high risk of homicide among younger Blacks. For example, the fact that homicide is the major cause of death among Black men between ages 20–39 would be obscured through the use of total mortality statistics. Whether emphasizing the risk among Blacks of death from homicide would enhance or diminish the acceptability or effectiveness of HHA/HRA among Black clients requires further study.

HHA/HRA's highly quantitative presentation generally demands a higher-than-average educational background. The focus on modification of personal behaviors to increase longevity appears to have a weaker impact for persons for whom securing current necessities dominates their attention. Presumably for this and other reasons, participation by less-advantaged groups has been low in programs that have attempted to recruit clients from among these groups. There is no evidence as to the impact of HHA/HRA or related techniques on such clients, which we view as a major research need.

8. *What are the major areas regarding HHA/HRA that are in need of further research?*

We recommend increased research activity in the following areas:

- The determinants of health-related behaviors and the factors that sustain them,
- Strategies for motivating and supporting health-related behavior change with special attention to those that take a positive orientation,
- The attitudes and beliefs of minority groups toward HP/DP and the barriers to their participation,
- The role and impact of the medical practitioner in HP/DP,
- The possible harmful effects of HP/DP interventions particularly those using personalized risk information,
- The source of errors in data collection and their

impact on the message given to clients of HHA/HRA programs,

- The perceptions and knowledge of HHA/HRA clients regarding the information collected from them and returned to them, and
- The efficacy of HHA/HRA, as compared to other approaches, in stimulating participation in risk reduction activities and producing health-related behavior change.

Conclusion

Health hazard/health risk appraisal (HHA/HRA) is an appealing technique which may have potential as a tool in health promotion/disease prevention (HP/DP) efforts. Its attraction derives probably as much from the lack of packaged options for individuals working in HP/DP as from demonstrable effects of the HHA/HRA process. We feel that the current degree of attention given specifically to HHA/HRA may be excessive and that such a concentration of interest risks missing the forest (HP/DP) for the tree (HHA/HRA).

HP/DP is an area which requires innovative programming and careful evaluation of results. HHA/HRA is but one approach and should be viewed with care and circumspection—care to ensure that assumptions are tested, and circumspection in view of the paucity of current evidence regarding its effectiveness. Caution is also indicated since HHA/HRA programs, like other HP/DP efforts aimed at modifying personal behaviors, have the potential for the promulgation of life-styles possibly inadequately supported by existing scientific evidence and/or inconsistent with values and traditions of specific population groups. There are also concerns that such programs may constitute “blaming the victim” or may pay insufficient regard to the influence of environmental and social factors on health and health-related behaviors.

Programs attempting to change behaviors and improve health have been searching for effective tools. Our evaluation of the current state of the art in HHA/HRA suggests that there is no reason to abandon that search.

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