USE OF REACH AND FREQUENCY DATA FOR EFFECTIVE PLACEMENT OF ADVERTISING

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Abstract

A mathematical model based upon magazine audience reach and frequency data and personal probabilities of readers of seeing advertisements is developed. The model enables the media planner to establish and evaluate schedules with respect to **advertising reach and frequency**.

Introduction

One of the problems confronting an advertiser when using print media is the determination of the number of issues to be used for his advertising copy. The number of placements will generally be related to his advertising goals. They may range from awareness advertising for a new product to promoting the special features of an existing product, to creating favorable attitudes or images toward a product or company. All are designed in concert with other critical variables to aid in achieving a behavioral goal such as a purchase.

While a single piece of advertising copy may not accomplish all or parts of these goals, repetition of the same copy may do so. Repetition of the ad can widen the reach or audience for the advertiser's message. It can also be used to reinforce his message. However, repetition of the same ad is subject to wear out and may have diminishing effects. Too much repetition may even cause irritation.

The uses, effectiveness and misuses of repetition have been the subject of many advertising investigations involving controlled experiments. These have been summarized by Bogart (1990) and Sissors and Bumba (1991). While some general principles for achieving "effective frequency" are known, practical measures for the deter-mination of "effective frequency" for periodic print media is lacking. Definitional problems and a scarcity of relevant data characterize this deficiency.

In this paper we shall demonstrate how advertising exposure in print media can be measured and "effective frequency" determined through the use of a mathematical model. In doing so, we start with two basic assumptions. The first relates to the advertising process itself. Hypothetically, let us assume that a prospect will become aware of the advertised product with one or two exposures, that the prospect will learn something about its unique properties with three or four exposures and that five or more exposures are wasted. Once again, these parameters are used simply for illustrative purposes.

A second assumption is that the probability of a reader being exposed to a single advertising page is known. This is a personal probability model. It can be expanded to take into account differing probabilities of exposure for different media vehicles for different socio-economic and demographic groups, as well as for different behavioral groupings such as people "in the market" versus those "not in the market" for the advertised product.

With these simplifying assumptions the illustrations which follow are designed to reveal something about the nature and consequences of repeat placements in different types of print vehicles.

Development of the Model

Definition of Terms

The development and use of a model requires relevant and precise definition of the terms involved. In reviewing the literature we found that there was no standard terminology. A term may have been used for one concept by one author and for an entirely different concept by another. We also found that some terms, while apparently specific, were misleading to advertisers. In 1982, Jack Sissors called attention to this in his paper "Confusions About Effective Frequency" which appeared in the December issue of the **Journal of Advertising Research**.

Vehicle Versus Advertising Exposure

Sissors pointed out that much of the work on advertising frequency does not distinguish between vehicle frequency and advertising frequency. For example, the title of this paper "reach and frequency" refers to the **vehicle** and not to the **advertising**. Some media planners incorrectly assume that the reach of the advertising within the print medium is identical to the reach of the medium itself. Advertising exposure is less than vehicle exposure. Some research work has been published and cited where the term "OTS" (opportunity to see) has been used as if it were advertising exposure. In reality, it is vehicle exposure.

Exposures Versus Persons Exposed

The term "exposure" of advertising was originated by Alfred Politz in the 1950's when he introduced the concept of Advertising Page Exposures (APX) for magazines. He defined it as a measure of the number of days the average advertising page in a magazine is exposed to a reader. The basic unit is the opening of a magazine page carrying advertising by the reader during a single day. This statistic does not indicate the **number** of **different** people exposed, but rather it is the product of the number of people exposed and the average number of days each person is exposed. APX is a quantitative assessment of the audience delivery of the advertising page within the media vehicle. It provides a basis for determining how well a print medium performs its basic function. It is concerned with the vehicle as a transmitter of advertising messages.

At the receiving stage it is necessary to have a measure of the number of **different** people who are exposed to an advertisement or at least who opened the page spread containing the advertisement. This may be referred to "as persons exposed." In the late 1950's, Audits & Surveys developed a technique for obtaining this measure. The procedure was validated among subscriber households through the use of the "glue spot" technique as well as calibrated for readers in non-subscribing households.

How does one distinguish between exposures, (APX), and persons exposed? In the former, if a magazine reader had opened to an advertisement page on two different days it is counted as two **exposures**, whereas in the other measurement of persons exposed, two page openings by the same **person** on two different days is counted only once. For APX, exposure more than once on the same day is counted only once.

Frequency and Repetition

These terms have often been used in two different senses. Their most common usage is when planning an advertising media schedule. One may use several issues of the same magazine to achieve repetition. One may also use different issues in different magazines to achieve repetition. In this sense, frequency simply refers to issue insertions.

These terms have also been used to indicate the repeated referral on different days by the reader of a magazine to the same advertising page. The APX measurement reflects this.

In another sense, frequency has been used to indicate exposures to the same advertisement on the same day in the same issue or on different days. There are specific magazines where readers return to the same issue to complete reading an article which can claim high frequency and often greater APX.

The Mathematical Model

The mathematical model basically involves a simple application of the Binomial Distribution. An advertisement appears in an issue of a magazine. The reader has a certain probability of being exposed to the advertising through the opening of the page where the ad appeared. Call this probability, P. The probability of not being exposed is (1-P). If the advertisement appears in two issues and the same basic probability holds then the probability that he is exposed two times in the two different issues is P x P or P^2. Similarly, the probability that he has not been exposed in two opportunities is $(1-P)^2$. The probability that he has been exposed exactly once is 2P(1-P). The Binomial Distribution provides the mechanism for computing the probabilities of any number of exposures up to a specific number of opportunities.

$$Bin(E,R) = \binom{R}{E} P^E (1-P)^{E-R}$$

For a media schedule, an advertiser may decide to place an advertisement in N different issues of a magazine. On the basis of readership surveys, he can obtain estimates of the cumulative audiences generated by the magazine. In addition, he can obtain estimates of the repeat audiences. These latter figures indicates the number of people who have read exactly one issue, exactly two, exactly three and so forth. These numbers are also the same as the numbers of people who have had varying **opportunities** of being exposed to the advertisement.

$$Prob(E_i|N) = \sum_{j=1}^{N} Bin(E_i, R_j) \cdot R_j|N$$

By multiplying the repeat audiences by the probabilities derived from the Binomial Distribution, the number of people exposed to the advertisement as well as the number of times within each repeat audience can be estimated. These numbers are then summed to obtain the distribution of the numbers of persons who have been exposed to varying numbers of advertisements.

$$R_j|N = \binom{N}{R_j} \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha+\beta+N)} \frac{\Gamma(R_j+\alpha)}{\Gamma(\alpha)} \frac{\Gamma(N-R_j+\beta)}{\Gamma(\beta)}$$

Nowadays, accumulated audience estimates **beyond** two issues are usually obtained not from direct observation but by an estimating procedure which utilizes actual measurements of the single issue and two issue audiences and an estimating model for the balance. Through empirical tests the use of the Beta Binomial Distribution has been shown to provide such estimates with excellent reliability.

Examples

In the following set of examples, published data have been used to measure magazine audience accumulation and repetition. To date, there has been little published data documenting the probability of **persons** being exposed to an average advertising page in a magazine. In the Audits & Surveys' study of advertising page exposures in LIFE and LOOK MAGAZINES, the probabilities of an advertising page being exposed at least once to a reader, ranged from P=.75 to P=.90 among individuals in subscribing households. In a study conducted by Mediamark Research in 1980 for Reader's Digest, this probability among readers in subscribing and non-subscribing households was P=.70. In the examples which follow we have examined situations where P=.5 and where P=.8.

Reach and Effective Frequency of Advertising Exposure Generated by Weekly Magazines

Figures 1 and 2 indicate how reach and frequency of advertising are generated by repeated insertions in weekly magazines. In Figure 1, it is assumed that in a weekly picture magazine the probability a person being exposed to an average advertising page is, P=(.5). Figure 2 depicts a weekly news magazine which has more editorial content and fewer pictures, with a probability of advertising page exposure of, P=(.8). It is assumed that twelve successive placements are made for each magazine. For purposes of illustration it is also assumed that the average issue audiences and audience accumulation are the same for both magazines.

It is shown in Figure 1 that with a single placement, 10 percent of the population is exposed to the advertisement. With the second placement, some of these people will be exposed a second time and the others will not. At the same time, 50% of those who did not see the first issue will generate additional advertising exposures. Also, at the same time, half of those who saw the first issue but were **not** exposed to the advertising will become exposed. Thus, those seeing one or two advertisements in the two issues will grow to 17.4% of the population. As the audience grows through accumulation, some of those in the one or two exposure group will move on to the 3 and 4 exposure group, some will remain in the same group and others enter the 1 and 2 exposure group. This process continues through 12 placements.
In Figure 2, the "reading" magazine, which has the same average issue and audience accumulation vehicle as the picture magazine will generate people exposed to the **advertising** at a **faster** rate.

Reach and Effective Frequency of Advertising Exposure Generated by Newspapers

When a daily newspaper is used as a vehicle for advertising, audience accumulation is slower, although the probability of exposure to advertising could be higher than that for a magazine. In Figure 3, we have used the case of a typical newspaper setting, P=.8. This is the same figure as in the previous example. The increased effect of people exposed to the advertising in this media vehicle can be seen.

Reach and Effective Frequency of Advertising Exposure Generated Through Use of Two Magazines

Audience repetition has an important effect on advertising exposures. We have obtained data from an article by Peter Danahar, recently published in the November, 1992 issue of **The American Statistician**. A readership survey was conducted by AGB McNair New Zealand Ltd. It was titled the "National Media Study" wherein readership data on magazines were gathered. For two weekly periodicals, Women's Weekly and New Zealand Listener, audiences for four issues of each magazine, as well as the distribution of repeat audiences for the four issues of each were measured. In addition, the repeated audiences for both magazines combined are shown. These are presented in Figures 4, 5 and 6, respectively.

Using the present model for these data we can, construct alternative advertising schedules. We assume first that the advertising exposure probabilities were P=.5 (Figure 7) and P=.8 (Figure 8). The percent of the population exposed to the advertising in these print vehicles is highly dependent upon the repeat audiences generated by each vehicle and by the combination of the two.

Discussion

The model developed here can be used to determine the reach and frequency of advertisements appearing in a series of magazine issues. It requires knowledge of (1) vehicle exposures and repeat audiences and (2) the probability of readers being exposed to **advertising pages** within an issue. Most of the readership and audience characteristic studies have provided measures of vehicle exposure. However, measurements of the second type are infrequent and the few that have been made are not too well known.

Many analysts in their attempts to define effective reach and effective frequency without knowing the values of the probabilities of exposure to advertisements in magazines have bypassed the concept and resorted to the expression "Opportunity to See." Here the probability of advertising exposure is equal to one and is identical with vehicle exposure. From studies based on this type of analysis erroneous implications concerning "effective frequency" were published. Cannon and Goldring (1986) and Sissors and Bumba (1991) and pointed out the fallacy of using OTS and indicated the cause of these false conclusions.

An advertiser depending upon the results of the OTS or vehicle exposure formulation can be misled. In a schedule of advertisement placements both the reach and frequency of advertising exposure are overstated.

This is shown in Figure 9, where the probability of advertising exposure is set at 1, as in the OTS case, and at a more realistic exposure probability, p=.8 and at exposure probability, p=.5.

The model used here does not involve "advertising exposure days" (APX). Measures of APX are useful and serve a different purpose. They provide the advertiser with a measurement of how well a magazine delivers advertising pages to its readers, both in total and for various demographic or behavioral groups of readers. However, it does not indicate the number of **different** readers that have been reached. Under APX, a person exposed to the advertising page on two different days counts the same as two people exposed one day each. Thus, APX has little value in establishing reach and frequency of advertising exposure to different readers.

In the present model, it has been assumed for the purpose of simplicity, that the probabilities of ad page exposure is constant for all readers of a magazine.

In the real world these assumptions are not wholly correct ones. Readers of magazines are not homogeneous. There are also classes of magazines as well as special interest magazines wherein readers are more intensely involved with these vehicles and use them for different purposes. Specialized advertising appearing in Hobby magazines will tend to have different advertising exposures than the same advertisement in general magazines. Once the values of these parameters are known the basic model presented can be further expanded.

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FIGURE 1

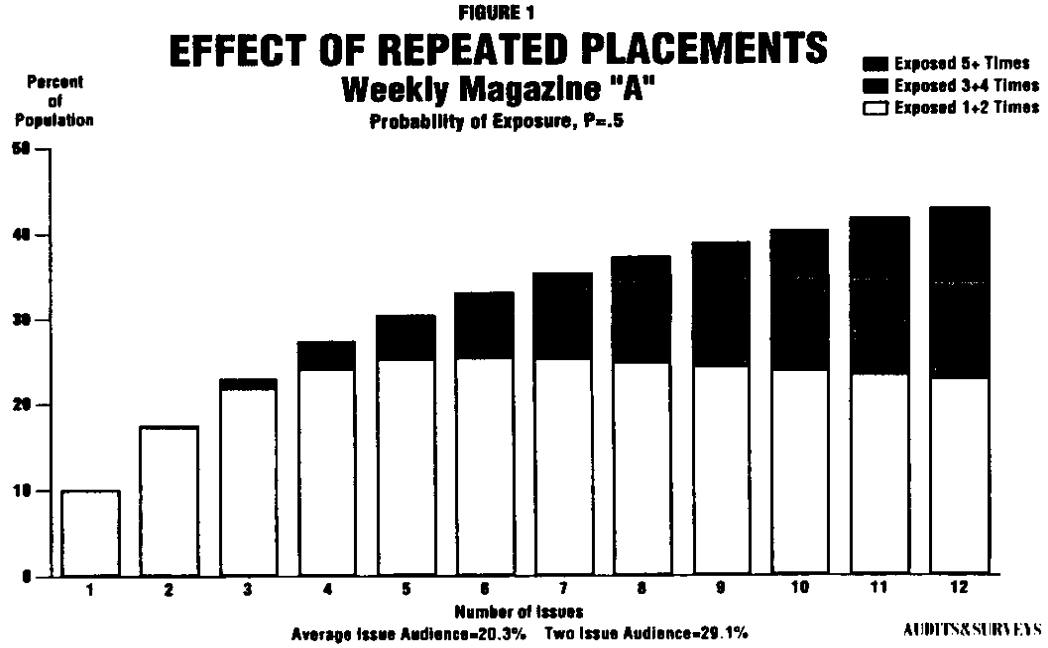


FIGURE 2

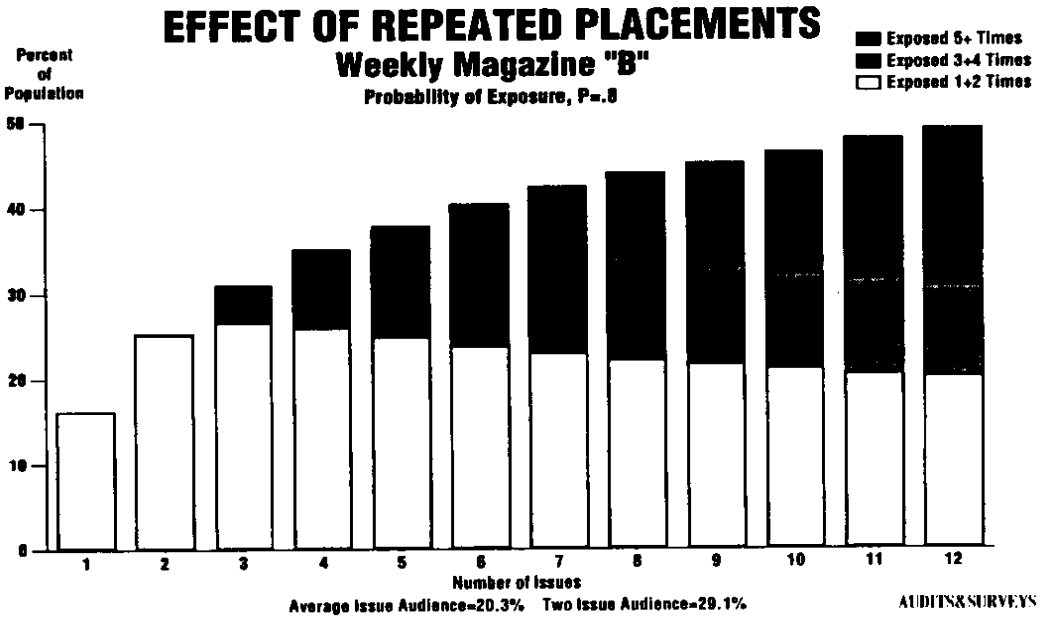
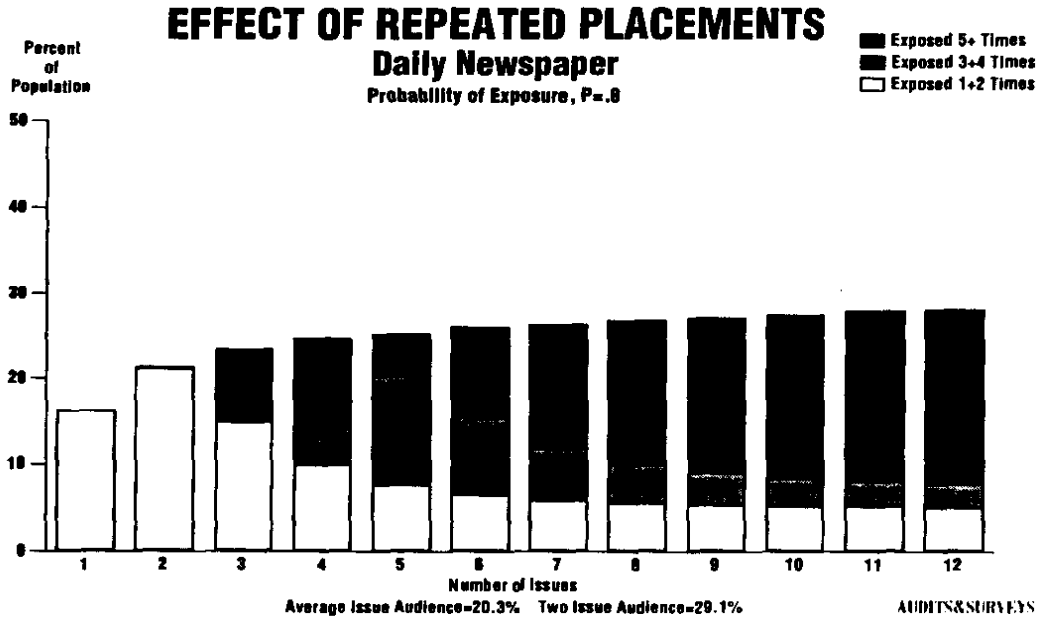


FIGURE 3


EFFECT OF REPEATED PLACEMENTS
Daily Newspaper
Probability of Exposure, P=.8
Exposed 5+ Times
Exposed 3+4 Times
Exposed 1+2 Times
Percent of Population
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12
Number of Issues
Average Issue Audience=20.3% Two Issue Audience=29.1%
AUDITS&SURVEYS

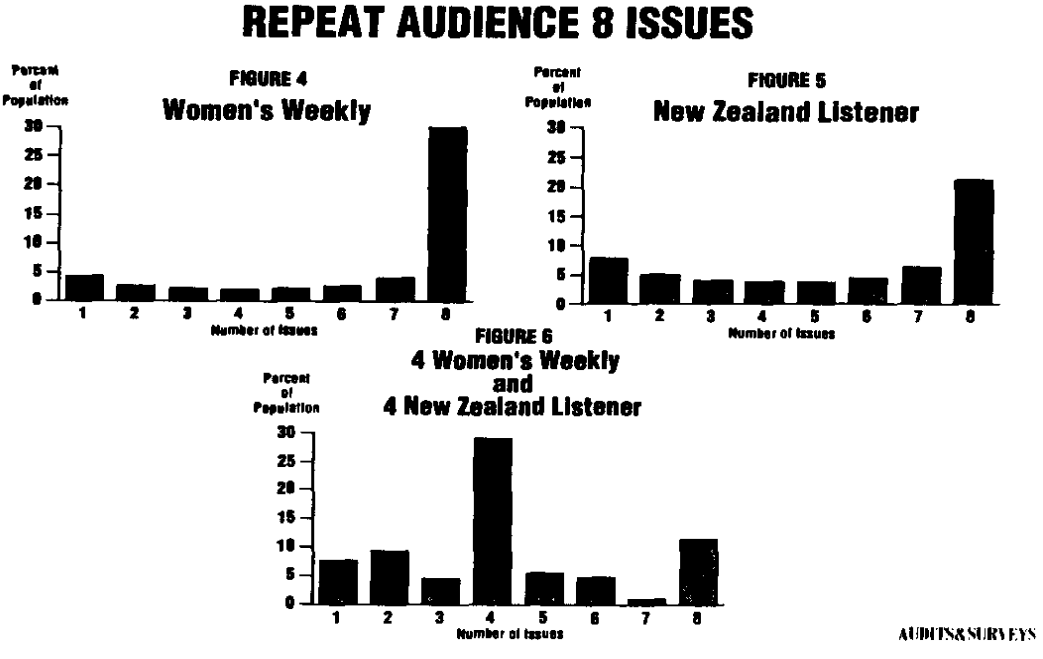

REPEAT AUDIENCE 8 ISSUES
FIGURE 4
Women's Weekly
Percent of Population
30
25
20
15
10
5
0
1 2 3 4 5 6 7 8
Number of Issues
FIGURE 5
New Zealand Listener
Percent of Population
30
25
20
15
10
5
0
1 2 3 4 5 6 7 8
Number of Issues
FIGURE 6
4 Women's Weekly
and
4 New Zealand Listener
Percent of Population
30
25
20
15
10
5
0
1 2 3 4 5 6 7 8
Number of Issues
AUDITS&SURVEYS

FIGURE 7

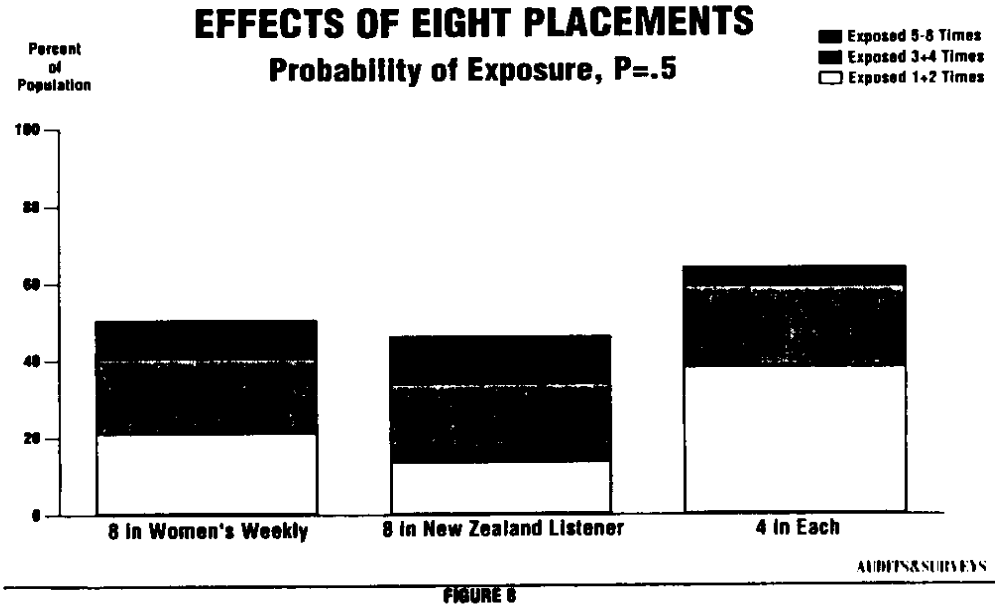


FIGURE 8

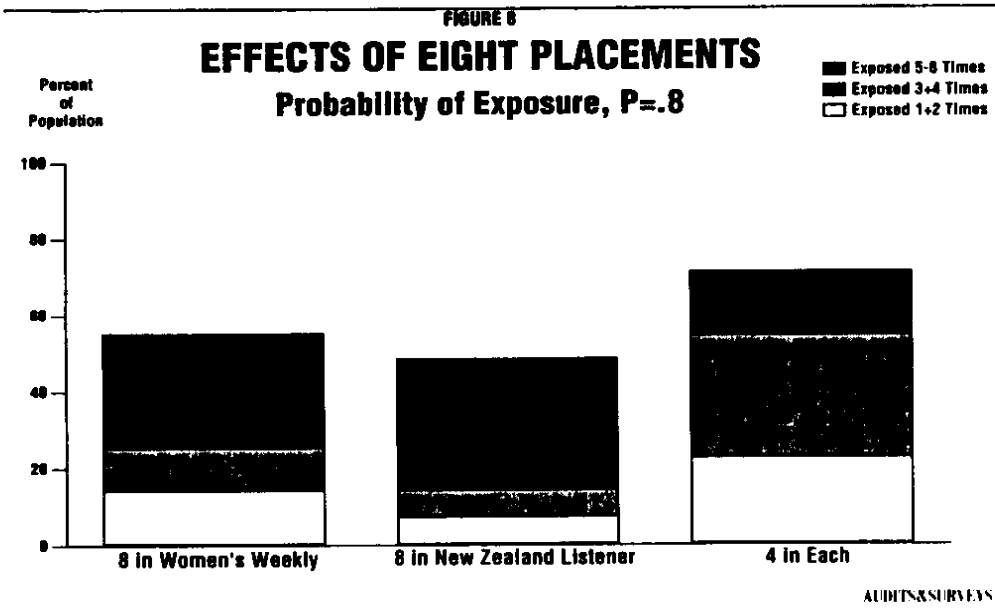


FIGURE 9