CHAPTER 2

HISTORY AND BRIEF REVIEW OF RR MODELS.

2.1 Introduction:

In this chapter, we are presenting a brief review of RR models. Era of RR models started with introduction of first RR technique by Warner [1965]. Thereafter various RR techniques were developed by many researchers.

During the period of past twenty nine years period, not only various RR models were developed but also different aspects of these models were critically studied. A few case studies of RR techniques are available in the literature. Number of reviews on RR techniques are also available. Important reviews among these are as follows:

1. A brief but systematic review on RR models is published in a special issue of International Statistical Review Journal by Horvitz et.al [1975].

2. Another enhanced review is presented by Chaudhuri and Mukerjee [1987].
Most of the aspects of the RR models are covered in a special monograph published on Randomized Response Technique by Chaudhuri and Mukerjee [1988].

RR techniques can be classified into different classes in many ways. Criteria for classifications can be as follows:

A. (a) RR technique without unrelated question.
   (b) RR technique using unrelated questions.

B. (a) RR technique for dichotomous data.
   (b) RR technique for polychotomous data.

C. (a) RR technique for qualitative data.
   (b) RR technique for quantitative data.

Classification of RR techniques on above lines is frequently found in the literature, however, attention has not been paid to classification by number of devices used, which may be an important aspect.

It may be noted that these classifications are neither mutually exclusive nor exhaustive.
2.2 **Brief Review** :

A few techniques, that have relevance with the research work presented in the thesis are discussed in brief here. Reason for this is to have quick reference and continuity.

Initial RR technique by Warner [1965] deals with one sensitive character. A random sample of size \( n \) is drawn from the population by SRSWR. Each respondent from the sample is asked to perform a random experiment using some randomization device. The device is either a spinner or a pack of cards or a coin etc. The whole procedure is unseen by an interviewer so respondent feels free to report.

The confidence of people can be further increased by incorporating unrelated questions in the method along with questions on sensitive character.

Use of unrelated question in RR Technique for the first time was proposed by Greenberg et.al. [1969] on suggestions by Simmons. If the involved parameter of unrelated question is known, one sample is sufficient but if it is unknown then we need two samples for estimation. Such techniques were proposed by Greenberg et.al. [1969].
Folsom et al. [1973] further suggested an interesting RR technique where two unrelated questions are used along with sensitive character. Here respondent has to give two answers. The first answer for a question which comes through randomization and second answer is for an unrelated question which is asked directly (not related with sensitive character).

Takahasi and Sakesagawa [1977] proposed a RR technique for dichotomous data which uses a different type of randomization. The technique uses three independent cards and three independent samples drawn by SRSWR from the population. Respondent from the $i^{th}$ sample is given a $i^{th}$ card ($i=1, 2, 3$). Further a random experiment is performed by the respondent and a response is given as per the defined procedure.

Chow and Liu [1973] suggested a new RR technique requiring more than one trial. The device used is a spherical glass flask with long neck containing balls of two colours. Neck can contain finite number of balls. Respondent from the sample is asked to report number of balls of a particular colour depending upon status of respondent, falling in a neck when it is turned upside down after a shake.

Recently, Mangat and Singh [1990] proposed a new RR technique. The proposed technique is based on two stage randomization where two randomization devices are used. These are two packs of cards. Responses are of yes or no type. The method does not make use of any unrelated question.
The same method was further modified by Mangat [1992] by incorporating unrelated questions in it.

Kuk [1990] suggested another interesting RR technique for dichotomy which uses two packs of cards of different colours (in different proportions). Here also responses are of type 0 or 1.

Various other techniques are available in the literature, that are useful for quantitative or polychotomous data. To mention a few we refer to the work of Greenberg et. al. [1971], Eriksson [1973b], Abul Ela et. al. [1967], Liu, et. al. [1975], Peddada and Saxena [1991].

There are many more interesting techniques that are discussed in the literature. However the material presented in the thesis does not have any connection with them hence those are not discussed. References of these are given in second bibliography.

Below we enlist some of the randomization devices that are commonly used in RR technique.

1. Spinner
2. Coin (biased or unbiased)
3. Packs of different types cards
4. Glass flask with long neck

5. Glass jar with small slit containing beads of different colours and one bead is observed in slit when it turned upside down.

6. Concentric movable marked discs.

In RR techniques mostly maximum likelihood estimation method or method of moments are used for estimation purpose. The estimation problem in the framework of decision theory is also considered by many researchers on the line of unified theory of sample survey and many useful and interesting results have been derived by them. However, these aspects are not considered in the present thesis.