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## The Vietnam Era Twin (VET) Registry: Method of Construction

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**Abstract.** A Vietnam Era (1964-1975) Twin Registry of American male-male veterans born between 1939 and 1955 has been developed to provide a study sample for research evaluating the impact of Vietnam service on the medical and psychosocial aspects of health. In preparation for developing the Registry, several alternative sources of twins and methods for identifying twins were investigated. A computerized database of veterans discharged from the military after 1967 was selected as the source because it contains about 50% of the total Vietnam era veteran population, is reasonably unbiased, and provides a feasible method for identifying twins. Twins were identified using an algorithm which involved matching entries on the database for same last name, different first name, same date of birth, and similar social security number. Twin status was confirmed by review of military records. The registry, now complete, is composed of 7,400 twin pairs. It will be an important resource for future research projects.

**Key words:** Twins, Registries, Vietnam War, Veterans

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## INTRODUCTION

In the wake of America's reassessment of its attitudes towards the Vietnam War, persistent and increasing concern has developed about possible long-term psychological and physical effects of the war on its servicemen. Consequently, the Veterans Administration (the government agency responsible for providing services to American veterans) has been encouraging research to clarify the relationship between Vietnam military service and current health.

The Veterans Administration's Medical Research Service, Cooperative Studies Program has provided funds to perform the Vietnam Era Twin Study (VETS), a research project which will assess the long-term effects of the Vietnam experience on health by studying twin pairs where both siblings served in the military during the Vietnam era. The first step in the project was the development of a registry of Vietnam era twin pairs. The present paper describes the construction of this registry. A companion paper [5] examines the issue of bias in the registry.

## METHODS AND RESULTS

### Eligibility Criteria

Eligibility criteria for entry into the Vietnam Era Twin (VET) Registry are: male-male monozygotic and dizygotic twins born between 1939 and 1955 where both siblings served in the armed forces of the United States between 1964 and 1975.

### Approaches to the Ascertainment of Veteran Twin Pairs

Two general approaches are available for identifying veteran twin pairs. The first starts with state-based twin registries and attempts to determine whether the known twins on the state registries served on active duty during the Vietnam era. The second starts with computerized records of individuals with known military duty during the Vietnam era and attempts to identify twin pairs. Both approaches were piloted to determine the best method for constructing the VET Registry.

#### *1. State Based Twin Registries*

Twin registries are maintained by several states in the United States. For example, the states of California, Virginia, and Connecticut have computerized registries of twins identified at birth using birth certificates [1,3]. It is important to note that these registries do not continue to collect data on twins as they age. The process for identifying the subset of twins found on state registries who meet the VET Registry eligibility criteria was pilot tested with 55 twin pairs randomly selected from pairs born in the state of Connecticut during the years of interest.

The selected pairs were matched against a comprehensive computer based list of discharged servicemen. The comprehensive list of discharged servicemen and their military records are located at the National Personnel Records Center (NPRC), St. Louis, Missouri. Because the NPRC contains 70 million records (including those of approximately 9 million Vietnam era veterans), no uncommon names exist. The only relevant information coded

on the computer file are names, social security or military service numbers, and military record location numbers. The matching of the 55 Connecticut twin names with the NPRC computer file produced thousands of potential twin pairs. Many names could be eliminated, though, either because both twins were not listed or because the social security or military record location numbers excluded the particular names from military duty during the Vietnam era. Still, many names (sometimes hundreds) typically matched pairs. It was then necessary to obtain the stored military records and compare places of birth and parents names to determine whether a matched pair were in fact twins.

## *2. Computerized Records of Military Service*

**The National Personnel Records Center (NPRC).** To identify potential twin pairs using the NPRC location registry, a matching algorithm using two variables on the computerized data file (name and social security number) was developed. The social security number is a nine-digit identification number issued to every American wage earner as part of the national retirement system. The first three digits of the social security number indicate the state in which the application was made. The next two digits are encoded to reflect the year of application. It was assumed that twin siblings made application for their social security numbers in the same state, at the same social security office, and on approximately the same date. Therefore, the first three digits of the social security number would be the same for twins and the subsequent six digits would be very similar. The twin status of matched pairs was confirmed by review of military records located at the NPRC.

**The Bonus State Files.** Following the Vietnam War, the following states in the United States offered monetary awards to discharged veterans who served during the Vietnam era: Illinois, Indiana, Iowa, Minnesota, New Hampshire, North Dakota, Ohio, Pennsylvania, South Dakota, Vermont, and Wisconsin. Veterans applied to the state in which they lived for their Vietnam era service "bonus". Many of the states developed computerized application and disbursement records which can be used to identify potential twin pairs. While states varied in the data elements which were entered into the bonus files, most contained name, sex, race, date of birth, and a social security number. To identify twins from these files required developing a computer matching algorithm. Twin status was confirmed by reviewing military records at the NPRC.

**The Beneficiary Identification and Record Locator Subsystem (BIRLS).** The BIRLS, a computerized listing of veterans who have filed for a benefit with the Veterans Administration, is maintained in a standard format and includes name, date of birth, race, and social security number [15]. Potential twin pairs were identified by developing a computer matching algorithm similar to those previously described. Confirmation of twin status required examination of military records at the NPRC.

**The Defense Manpower Data Center (DMDC).** The United States Department of Defense, at the Defense Manpower Data Center (DMDC), maintains a computer file of servicemen who were discharged from active military duty beginning in 1968. The DMDC claims to have a complete listing of all discharges after 1972; between 1968 and 1972, the proportion of all discharges contained in the DMDC computer files is unknown. The DMDC computer files contain between four and five million Vietnam era veterans (about 50% of all Vietnam era veterans) [14]. Potential twin pairs were identified using a matching

routine based on name, date of birth, and social security number. Confirmation of twin status was performed by military record review at the NPRC.

### Summary of Approaches of the Ascertainment of Veteran Twin Pairs

A summary evaluation of possible sources of veteran twin pairs is presented in the Table. Feasibility and bias are the two criteria which form the basis for evaluation. Feasibility addresses the issue of whether it is possible to construct a large twin registry from a particular data source given the constraints of time and money. Bias addresses the issue of whether a systematic error in the ascertainment source might substantially compromise the subsequent utility of the VET Registry.

The major advantage of state twin registries is that they contain the universe of twin pairs born in a state during a specified time period and are therefore unlikely to be biased. However, since state registries usually contain a limited amount of information, determining whether both members of a pair served on active military duty during the Vietnam era is time consuming and expensive. Using the NPRC registry as a source of twins is also not feasible; the scant number of variables and the large number of veterans included on the registry precludes the development of a computer matching algorithm that has sufficient sensitivity. Both the Bonus State files and the BIRLS can be used to identify twin pairs at low cost. However, the potential for health related bias is large, since both members of a twin pair must have applied for a bonus or Veterans Administration benefit. The DMDC database permits rapid and low-cost identification of potential twin pairs. A known bias in this database is that it contains records for only those veterans who were discharged beginning in 1968.

After carefully considering the advantages and disadvantages for constructing the twin registry from each of the above sources, the DMDC database was selected because it contains a large proportion of the total Vietnam era population (about 50%), is reasonably unbiased, and is a feasible method for identifying twins.

### Final Method of Identifying Twin Pairs in the DMDC Database

Only about 12% of pairs of DMDC registry members who had the same last name, different

Table - Potential sources of veteran twin pairs

Ascertainment source	Implementation feasibility	Biases
State Twin Registries	Time consuming and costly	None likely
National Personnel Records Center Registry (NPRC)	Time consuming and costly	None likely
Bonus State Files	Rapid and low cost	Biased toward veterans who requested a "bonus" from the state
Beneficiary Identification and Record Locator Subsystem (BIRLS)	Rapid and low cost	Biased toward VA benefit applicants
Defense Manpower Data Center (DMDC)	Rapid and low cost	Biased towards veterans discharged after 1968

first names, same date of birth, and the same first three digits of the social security numbers were demonstrated to be twins after review of their military records. This twin identification rate was too small to be an economical method for construction of the VET Registry. Narrowing the criteria to include matching on the first five digits of the social security number, however, increased the proportion of possible pairs proven to be actual pairs to 50%. Therefore, this was the final matching criteria selected for construction of the Registry.

The Registry is now complete. It contains 7,400 twin pairs. The addresses of Registry members are currently being obtained and a zygoty determination [13] and health survey questionnaire is being mailed.

## DISCUSSION

The present paper describes the construction of a new, large (7,400 pairs) twin registry which is based on military service during the Vietnam War era.

The study of twins offers unique opportunities for understanding the role of genetic and environmental factors in a wide variety of normal biologic processes and diseases [6,11]. The availability of registries of twins substantially facilitates the use of twins in research. Twin registries have been constructed using many different methods. These include all volunteer registries (eg, the Kaiser-Permanente registry) [4], disease focused registries (eg, the UCLA Registry for Genetic Studies in Autism) [12], registries where all members share a common, significant event (eg, the NAS-NRS Twin Registry of World War II veterans) [7], registries composed of a carefully constructed sample of a total population (eg, the registry developed from the National Health Examination Survey) [10], and national registries (eg, the Norwegian and Swedish registries) [2,9].

The registry described in the present article is event focused, since it is based on male-male twins born between 1939 and 1955 where both members of each pair served in the armed forces of the United States during the Vietnam era. It was constructed from a computer data file provided by the Department of Defense, Defense Manpower Data Center, which contains a list of servicemen discharged from active military duty beginning in 1968.

The major advantages of the VET Registry are that it is large and composed of a relatively young twin cohort who can be followed for many years. A detailed examination of ascertainment bias in the identification of twin pairs in the VET Registry is presented in a companion paper [5]. It should be noted that Registry members are likely to be both physically and psychologically healthier than the general male population born between 1939 and 1955 [8].

The NAS-NRC Twin Registry of World War II veterans is similar to the VET Registry. Both are composed of veteran twin pairs. The NAS-NRC Twin Registry was assembled by matching the names and dates of caucasian multiple births between 1917 and 1927 provided by 42 state vital statistics offices with a VA master index which contained 99% of all World War II veterans. Twinship was confirmed by review of military records. About 16,000 twin pairs were identified [7]. This registry has been used extensively to support diverse and important research projects. The VET Registry will supplement and substantially broaden the usefulness of the NAS-NRC Twin Registry.

The VET Registry will be administered in a manner similar to the NAS-NRC Twin Registry. Access to the Registry will be overseen by the Committee on Epidemiology and Veterans Follow-up Studies, Division of Medical Sciences, National Academy of Sciences-National Research Council. The Committee will review submitted proposals for scientific validity and encourage use of the Registry in a manner which insures long-term participation of the twins in research efforts. The first use of the Registry will be to support the VETS research project. It is expected that outside requests for access to the panel will be considered after 1989.

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