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# Month of Birth by Zygosity in the NAS-NRC Twin Registry

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Previous results regarding a seasonality of twin births have been conflicting. Since the biology of monozygotic (MZ) twinning differs from that of dizygotic (DZ) twinning, it is possible that the seasonality of birth for these two twin types might differ. However, all previous studies examining the seasonality of birth by zygosity has estimated zygosity by Weinberg's method. In this report, the month of birth of all MZ and DZ veteran twins from the United States National Academy of Sciences-National Research Council (NAS-NRC) Twin Registry are compared with that found for an unselected group of veterans. Zygosity in the registry has been individually assigned to all twin pairs by a well-validated method. Compared to unselected veterans, the distribution of births by months did not differ significantly for all the veteran twin pairs or for the MZ and DZ twin pairs considered separately. The distribution of month of birth of the MZ and DZ twin pairs did not differ significantly from one another. These results are not consistent with a significant seasonality of MZ, DZ, or all twin births in the United States.

**Key words: Twins, Seasonality of birth, Twin register**

## INTRODUCTION

A seasonality in all twin births has been reported by some [2,3,8,10,12,15] but not other investigators [4, 5, 14, 16]. The etiology of this seasonality, if it exists, remains uncertain. However, since the underlying biology of monozygotic (MZ) and dizygotic (DZ) twinning is different [1, 13], it is not improbable that if a seasonality of births exists, it will be different for these two twin types. All three investigations that have examined for a seasonality of birth in MZ and DZ twins separately have found a significant seasonality for DZ twin births [4, 8, 11], while only one found such seasonality in MZ twin births

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[8]. A methodologic limitation of these three studies is that they estimated zygosity using Weinberg's rule and not by direct assessment of each twin pair. Therefore, in this report, we examine the month of birth of the male twin pairs in the United States National Academy of Sciences-National Research Council (NAS-NRC) Twin Registry. On the basis mainly of questionnaire responses and anthropometric-fingerprint data, zygosity has been assigned to 13,487 (84.7%) of the twin pairs in this registry. The seasonality of birth of MZ and DZ twins can be examined in this registry in twins where zygosity has been directly assigned based on well-validated methods.

## MATERIALS AND METHODS

The details of the construction of the NAS-NRC Twin Registry have been outlined elsewhere [7, 9]. In brief, birth certificates for white male multiple births for the years 1917 to 1927 were obtained from 39 of the 48 continental United States. The approximately 54,000 births so identified were screened to select the 15,924 twin pairs where both members of the pair had served in the United States armed services. Zygosity has been assigned to the twin pairs, except those few pairs for whom blood typing is available, on the basis of responses to questionnaires, anthropometric measurements, and fingerprint data. When tested against blood typing, 95.0% of the 1,482 twins examined were assigned the correct zygosity by the current system. The average year of birth does not differ between the MZ and DZ twins. The comparison groups consists of 5,636 unselected men who served in the United States Army during the Second World War, the time period in which most of the twins in the registry were in active military duty.

Statistical analysis, using two techniques, was conducted on twin pairs and unselected individual veterans because with only rare exceptions, both members of the twin pair were born in the same month. The first statistical analysis was a heterogeneity $\chi^2$ analysis comparing month of birth of the twin pairs (all MZ and DZ) and the unselected veterans. The second statistical analysis employed the nonparametric test of seasonality of Hewitt et al. [6]. In this method, the months are ranked by twin type on the basis of the ratio of observed to expected births. Expected number of births was calculated on the basis of the distribution of births of the unselected veterans. This method was first used to test two specific hypotheses from the literature: that twin births would be highest in months with the greatest sunlight (April to September) [15], or highest in the latter half of the year (July to December) [10]. Second, this method was used to test whether any six-month segment during the year contained a significantly increased number of twin births. Not significant (NS) refers to values of P in excess of .05.

## RESULTS

By $\chi^2$ analysis, the distribution of months of birth for all twin pairs, MZ twin pairs and DZ twin pairs did not differ signficantly from that found for unselected veterans (Table). The month of birth of the MZ and DZ twins did not differ significantly ( $\chi^2_{11} = 16.35$, NS). Using the nonparametric test of seasonality of Hewitt et al [6], no significant increase in all MZ and DZ twin births was found in April to September, July to December, or in any other six-month period.

## DISCUSSION AND CONCLUSIONS

This report represents, to our knowledge, the first to examine seasonality of birth in MZ and DZ twins where zygosity was determined by individual assessment of each twin pair. The month of birth of all the veteran twin pairs from the NAS-NRC Registry did not differ significantly from that found for unselected veterans. When examined separately, the month of birth of the MZ and DZ twins did not differ from each other or from that found for unselected veterans. The results of this report do not support a significant seasonality of either all twin births or a specific seasonality for either MZ or DZ twins.

The reason for the discrepancy between this and previous reports is not immediately obvious. The sample size in this report is larger than that found in a number of previous

*TABLE 1. Month of Birth for Unselected Veterans and for All Monozygotic and Dizygotic Veteran Twin Pairs*

| Month | Unselected veterans | All twin pairs | | | MZ twin pairs | | | DZ twin pairs | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | O[a] | E[b] | O/E | O | E | O/E | O | E | O/E |
| Jan. | 504 | 1,321 | 1,424 | 0.93 | 503.5 | 531 | 0.95 | 616 | 676 | 0.91 |
| Feb. | 442 | 1,213.5 | 1,249 | 0.97 | 443 | 465 | 0.95 | 570.5 | 592 | 0.96 |
| March | 466 | 1,359 | 1,317 | 1.03 | 473.5 | 491 | 0.96 | 674 | 625 | 1.08 |
| April | 438 | 1,362 | 1,238 | 1.10 | 506 | 461 | 1.10 | 657.5 | 587 | 1.12 |
| May | 479 | 1,350 | 1,353 | 1.00 | 477.5 | 504 | 0.95 | 650.5 | 642 | 1.01 |
| June | 460 | 1,258.5 | 1,300 | 0.97 | 493.5 | 484 | 1.02 | 567.5 | 617 | 0.92 |
| July | 471 | 1,413.5 | 1,331 | 1.06 | 516 | 496 | 1.04 | 699.5 | 631 | 1.11 |
| Aug. | 502 | 1,469.5 | 1,418 | 1.04 | 577 | 528 | 1.09 | 668.5 | 673 | 0.99 |
| Sept. | 506 | 1,303 | 1,430 | 0.91 | 462 | 533 | 0.87 | 644 | 678 | 0.95 |
| Oct. | 492 | 1,369.5 | 1,390 | 0.99 | 522 | 518 | 1.01 | 612.5 | 659 | 0.93 |
| Nov. | 439 | 1,256.5 | 1,240 | 1.01 | 484.5 | 462 | 1.05 | 603 | 588 | 1.02 |
| Dec. | 437 | 1,248 | 1,206 | 1.03 | 474.5 | 449 | 1.06 | 590.5 | 572 | 1.03 |
| Total | 5,636 | 15,924 | | | 5,933 | | | 7,554 | | |
| $X^2_{11}$, month of birth, twin pairs versus unselected veterans | | 11.14 | | | 12.46 | | | 14.88 | | |
| P | | NS | | | NS | | | NS | | |

[a]Observed.
[b]Expected.

reports that found a significant seasonality of twin births [3, 4, 12, 15]. Cultural and geographic factors may be of importance, as both previous studies of twin births in the United States [5, 14] found no significant seasonality for all twin births. However, Elwood found a significant seasonality for DZ twin births in 14 large Canadian cities [4].

A potentially important methodologic limitation of this report is that the NAS-NRC Twin Registry is not a continuous sample of birth certificate-verified twin births. Only twins who served in the United States armed services were selected for the registry. It cannot be ruled out that this selection procedure introduced some bias that affected the distribution of months of births. However, by using as a comparison an unselected group of veterans such a bias should be eliminated. Furthermore, it is particularly difficult to imagine any bias that would selectively alter the month of birth of MZ or DZ veteran twins, thereby invalidating the comparison of month of birth between the two twin groups.

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