SUPPPLEMENT S1. Response Status for 2014 PTTS Survey by Family Group

|   | All Families | # Families with Non-Twin Siblings Responding b | Total Individuals Responding | Total Individuals |
| --- | --- | --- | --- | --- |
| One Sib | Two or More |
|  | *N* | *%* | *N* | *N* | *N* | *N* |
| **Total Family Groups** | **2233** | **100** | **216** | **16** | **2475** | **5003** |
| **Families with Twin Pairs** | **2216** | **99.2** | **213** | **13** | **2446** | **4952** |
|  Both twins responding | 714 | 32.0 | 80 | 6 | 1521 | 1601 |
|  One twin responding, one non-response  | 393 | 17.6 | 45 | 3 | 444 | 895 |
|  One twin responding, one deceased | 385 | 17.2 | 37 | 1 | 424 | 846 |
|  Both twins non-response | 282 | 12.6 | 21 | 0 | 21 | 626 |
|  Both twins deceased | 178 | 8.0 | 14 | 2 | 18 | 402 |
|  One twin deceased, one non-response | 264 | 11.8 | 16 | 1 | 18 | 582 |
| **Families with other multiples** a | **17** | **0.8** | **3** | **3** | **29** | **51** |
|  Two or more multiples responding | 9 | 0.4 | 2 | 3 | 23 | 28 |
|  One responding, others non-resp./deceased  | 6 | 0.3 | 1 | 0 | 6 | 16 |
|  All non-response or deceased | 2 | 0.09 | 0 | 0 | 0 | 7 |
| **Family level response** |  |  |  |  |  |  |
|  Two or more respondents | 813 | 36.4 |  |  |  |  |
|  At least one respondent | 1561 | 69.9 |  |  |  |  |

Note.

5 triplet sets had one member who did not participate in PT1960 and those individuals are not included in the table.

 a Includes 13 families with triplets and 4 families that each had two sets of twins

b Members of families with double twin sets contribute to both the twin and sibling counts.

**SUPPLEMENT S2.**  **PTTS Zygosity Algorithm Criteria and Scoring**

For each rater (twin or sibling of twin) who provided responses to the zygosity items, four variables were scored as shown in the table. The questionnaire item wording and response choices are available from the authors. Height and weight were asked as open-ended items; other items had three or four response options.

|  |  |
| --- | --- |
|  | **One point was given for each of the following:** |
| **DZ\_Level1** (0-4) | Height difference at age 20 >=3 inches (90th percentile of height difference) |
| Teachers rarely or never mistook twins when growing up 1 |
| Clear difference in eye color |
| Clear difference in shade of natural hair color or texture  |
| **DZ\_Level2** (0-6) | Slight difference in natural hair color or texture |
| Slight difference in eye color |
| Height difference at age 20 >=1.5 in. (70th percentile of difference) |
| Weight difference at age 20 >=15 lbs. (85th percentile of difference) |
| Other Relatives rarely mistook twins |
| Twin self-reports the pair as DZ |
| **MZ\_Level1** (0-2) | Brothers or sisters frequently mistook twins when growing up |
| Mother and father (averaged together) frequently mistook twins when growing up |
| **MZ\_Level2** (0-4) | Brother or sisters frequently or occasionally mistook twins when growing up |
| Mother and father (averaged) frequently or occasionally mistook twins when growing up |
| Other relatives frequently or occasionally mistook twins when growing up |
| Twin self-reports the pair as MZ |

1 defined as until age 18

Scoring system and algorithm adapted from Nichols & Bilbro (1966).

The four scores were then used to assign a zygosity category *for each rater* using a hierarchical algorithm:

* If DZ\_level1 >0, assign as DZ

 Else if MZ\_level1 >0, assign as MZ

* If DZ\_Level1=0 and MZ\_Level1=0, use the level 2 scores as follows:
	+ if MZ\_level2 > DZ\_level2, assign as MZ
	+ if MZ\_level2 < DZ\_level2, assign as DZ
	+ if MZ\_level2 = DZ\_level2, assign as indeterminate

The assignments of multiple raters were combined as described in the text.

**SUPPLEMENT S3.**  **Agreement of Zygosity Algorithm Assignments Based on Survey Responses from Twin Pairs and from Twin-Sibling Pairs**

|  |  |  |
| --- | --- | --- |
| *Assignment based on Responses from* |  |  |
| *Female Twins* | Female Cotwins(n=303) | Sibling of Female Twin(n=65) |
|  | MZ | Indeterminate | DZ | MZ | Indeterminate | DZ |
| MZ | 115 | -- | -- | 37 | 0 | 5 |
| Indeterminate | 20 | 6 | -- | 1 | 1 | 2 |
| DZ | 16 | 7 | 139 | 3 | 0 | 42 |
| *Male Twins* | Male Cotwin(n=218) | Sibling of Male Twin(n=91) |
|  | MZ | Indeterminate | DZ | MZ | Indeterminate | DZ |
| MZ | 95 | -- | -- | 24 | 2 | 1 |
| Indeterminate | 13 | 0 | -- | 0 | 1 | 2 |
| DZ | 14 | 3 | 93 | 1 | 1 | 33 |

Note. Triplets not included.

Data for twin pair agreement shown in lower diagonal because the person assigned to be “twin” and “cotwin” were randomly assigned for a pair.

**SUPPLEMENT S4.** **Sources Used for Zygosity Assignments of Same-Sex Twin Pairs**

|  |  |
| --- | --- |
|  | Available Survey responses |
|  | Both Twins(n=521) | One Twin(n=514) | No Twin(n=543) | TOTAL(n=1578) |
|  | Sib Report | No Sib | Sib Report | No Sib | Sib Report | No Sib |  |
| Photo review | 11 | 107 | 22 | 254 | 6 | 233 | 633 |
| No Photo review | 41 | 362 | 30 | 208 | 29 | 275 | 945 |
| TOTAL | 52 | 469 | 52 | 462 | 35 | 508 | 1578 |

Note.

Ns are number of pairs.

Sib Report = responses to zygosity items available from one or more non-twin siblings.

No Sib: sibling survey(s) not returned, sibling(s) deceased, or no identified sibling in PT.

No photo review: includes cases without photos, where photos were of inadequate quality to rate, and when photos were not considered informative because of the strength of the algorithmic assignment.

Triplet sets not included in table; all triplets received hand review.

**SUPPLEMENT S5.** **Procedure for Combining Information Sources to make Zygosity Classifications of Same-Sex Twin Pairs**

The procedure for assigning the final zygosity classification differed depending on the number of sources and type of information available. In general, assignments based on the algorithm were weighted more heavily than photo ratings. Here we summarize the procedure for twin pairs, organized by the number of individuals in a family who provided 2014 survey responses about a twin pair. Triplets were handled separately (as described below).

 For 521 same-sex twin pairs with both twins responding to zygosity items, photo ratings were included in the decision making only if algorithm assignments were inconsistent or inconclusive.

For the 282 pairs with i) one twin responding or ii) neither twin responding but one or more responding sibling(s), available photos were rated and the information compared to the algorithmic assignments. For the majority of these pairs, photo ratings agreed with the algorithmic zygosity or were indeterminate. For 19 pairs assigned as indeterminate by the algorithm, classification was made using photo ratings. In 32 pairs the photo ratings disagreed with the algorithm assignment. For 9 of these the photo ratings were considered strong enough to override the algorithm. For the other 23 the evidence was not considered strong and the algorithmic assignment was retained.

There were 233 pairs without any 2014 survey information but of whom photos were obtained. Consensus ratings of photos were used to assign zygosity for 213 pairs. Photos of the other 20 were of poor quality or consensus could not be reached.

The remaining 275 pairs with neither PTTS14 data nor photos were assigned as Unknown zygosity. Some of these pairs will be assigned as additional information is collected through yearbook photos and ongoing data collection.

Algorithm classifications were checked for consistency with other survey information, particularly twins’ opinion and the peas-in-a-pod item. Pairs with rater disagreements, having inconsistencies with other survey items, and with one or more algorithm classifications of Indeterminate were assigned for hand review.

All responses to open-ended items were read to determine their relevance for interpreting other information. For example, algorithm assignment as DZ on the basis of a “rarely or never confused” response was disregarded if one twin was reported to have a distinguishing physical feature (e.g., a prominent facial scar) and other responses and evidence were consistent with the pair being MZ. A respondent’s opinion that the pair was MZ was disregarded if the reason provided was unrelated to physical similarity (e.g., similar personalities, the delivery physician saying the pair was identical).

Across the sample, hand review was conducted for 139 twin pairs where zygosity was inconsistent between the algorithm and other sources. Consensus was reached for 113 pairs: 87 were assigned as MZ (77.0%), 19 as DZ (16.8%), and 7 as Uncertain (6.2%). The remaining 26 pairs had insufficient or inconsistent information and were assigned as Unknown.

Hand review of available survey and photo information was also conducted for the 13 triplet sets. Zygosity was assigned for 10 DZMF pairs and 10 same-sex pairs (two MZM pairs, two DZM, four MZF pairs, two DZF pairs). Another 19 pairs had insufficient evidence and were classified as Unknown zygosity.