Twinning Characteristics of the Amish Groups of Holmes County, Ohio

Henry Troyer
Retired Professor
Independent Research Specialist
Springfield, Missouri
hetroyer625@gmail.com

Abstract: The Amish are known for their high fertility and large families, but the Amish twinning rate has been of less interest. In an article published in 1970 (over 50 years ago), Cross and McKusick determined the Holmes County, Ohio, Amish twinning rate to be 15.3 twin pairs per 1,000 live births, which ranked among the highest known twinning rates at that time, while the U.S. national twinning rate hovered at around 9 per 1,000 per year. Within a few decades following the Cross and McKusick study, the twinning rates of the American population increased dramatically, and surpassed the Amish twinning rates. This surge in the twinning rate among the general American population was generally accredited to the widespread use of medically assisted reproduction (MAR), which favors multiple births, and the increased birth rates for older women, who have a significantly higher rate of multiple births.

Holmes County has eight different Amish sects, ranging from fairly progressive to ultraconservative, and the five largest ones were the subjects of this study. The twinning rates of the different groups vary, parallel with degree of conservatism. The New Order Amish (most progressive) have a twinning rate of 20.1 twins per 1,000 births, whereas the Swartzentruber Amish have a rate of 34.5. Since all the groups are of identical ethnic stock and share virtually identical historical experiences, these twinning variances are difficult to explain, but may be due to diverging dietary practices that paralleled the conservative fragmentation.

Introduction

The Holmes County, Ohio, Amish settlement began in 1809-10 after land in Ohio became available for settlement. The first Amish settlers came from Somerset, Pennsylvania, and were followed by many more settlers in the subsequent years. Today, the settlement stretches over large portions of three counties and smaller portions of two more counties (see Figure 1).

Figure 1

Approximate Area of the Holmes County, Ohio, Amish Settlement and the Subject of the Present Study
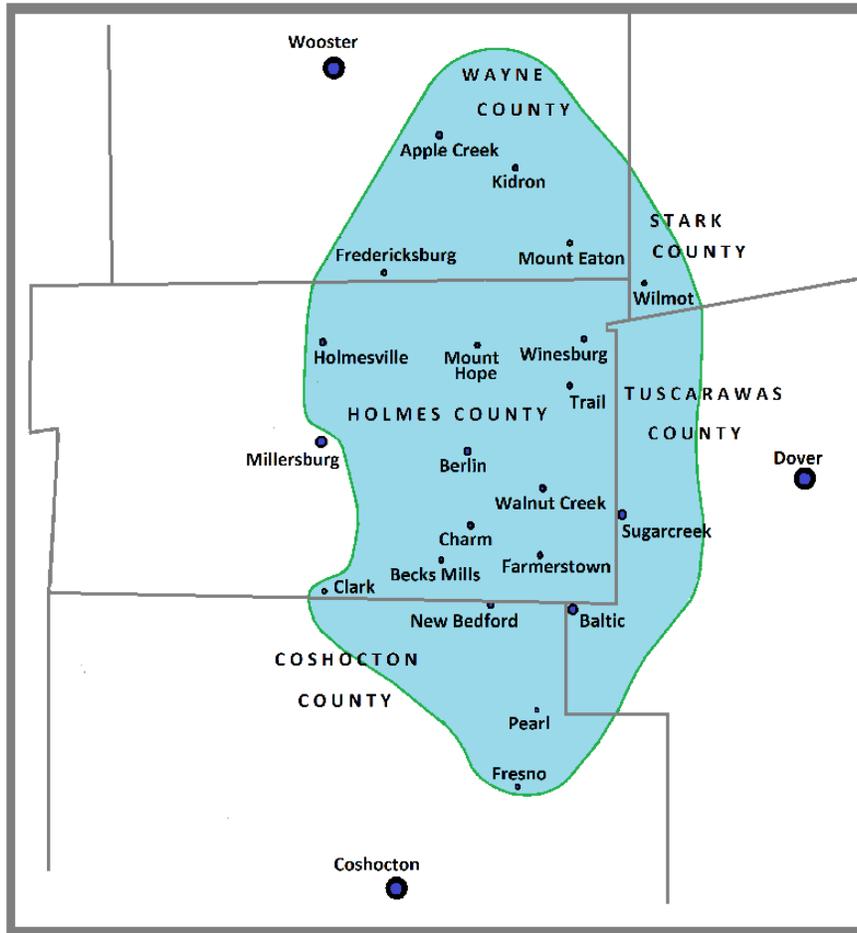
Over the years, divisions have taken place among the Amish, usually over theological issues, so that today there are eight affiliations of Amish occupying this settlement. These Amish groups still have most theological beliefs in common but differ in many details—details that may seem trivial to outsiders. Figure 2 shows how the main factions of Holmes County Amish are related historically. The mainline Old Order Amish group represents the continuation of the original Holmes County Amish.

Figure 2

Historic Relationships of the Various Holmes County, Ohio, Groups
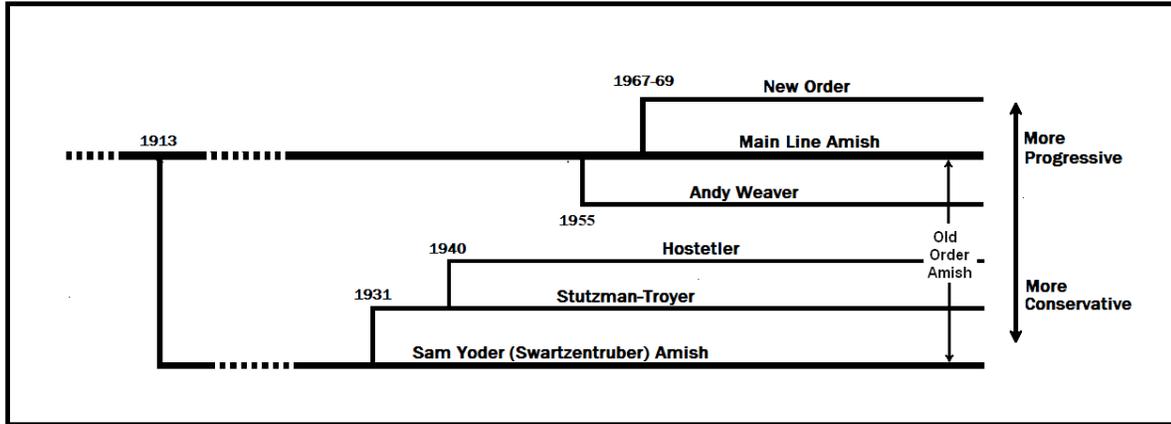
   The Amish are known for their high fertility and large families (Smith, 1960; Kraybill et al., 2013), but the Amish twinning rate has been of less interest. In the 1960s, Cross and McKusick (1970) determined the Holmes County, Ohio, Amish twinning rate to be 15.3 twin pairs per 1,000 live births, which ranked among the highest known twinning rates at that time when the U.S. national twinning rate hovered at around 9 per 1,000 per year. Within a few decades following the Cross and McKusick (1970) study, the twinning rates of the American population increased dramatically and surpassed the Amish twinning rates. This surge in the twinning rate among the non-Amish population was generally accredited to the widespread use of medically assisted reproduction (MAR), which favors multiple births, and the increased birth rates for older women. Older women have a significantly higher rate of multiple births.

   It is common knowledge that there are two kinds of twins: identical twins (having identical sets of DNA) and nonidentical twins (whose genetic makeup varies just as among singletons). Identical twins occur when a fertilized egg divides into two daughter cells, and each of the daughter cells proceeds to develop into separate individuals. Identical twins are called mono-zygotic (MZ) twins. Fraternal twins, on the other hand, develop from two separate eggs, which have been individually fertilized by two separate sperm. Coming from two separate eggs, they are referred to as dizygotic (DZ) twins. Various populations around the world have variable rates of twinning. However, only the DZ twinning rates vary significantly from population to population. The MZ twinning rate remains nearly constant throughout the world, always at an annual rate of about 4 pairs of twins per 1,000 births. Therefore, in this study, we will be mindful that it is the DZ twinning rates that are responsible for the observed variations.

   Many environmental and genetic factors affect the DZ twinning rates. The most important perhaps is the mother's age (the greater the age, the higher the twinning rate) and parity (how many children came before the twins). Other factors affect the DZ twinning rate, including diet, seasonality, geographic location (Hoekstra et al., 2007), and financial well-being and the mother's education (Beemsterboer, 2006).

All five of the Amish groups in this study came from the same European ethnic stock. They derived from the Amish branch of the Swiss-German Anabaptists, who had endured much oppression and persecution before immigrating to America. It was only after they settled in America (many in the Holmes County area) that they splintered into the factions that we have today. As Figure 2 shows, the groups range from very conservative to more progressive. Any demographic variations among the groups could not likely be attributed to environmental factors because they spent centuries living in the same area, nor would they be attributed to genetic differences because they are of the same ethnic stock. The Amish divisions we see today are based on disagreements over interpretations of excommunication and shunning and adoption of technologies, rather than on family or kinship. During this time in America, the Amish have maintained a separation from the mainstream American society, such as an endogamous marriage pattern. So, whatever influenced the demographic characteristics of the American mainstream would have affected the Amish minimally if at all.

Methods

Family data from various sources were collected for this study:

1. *Ohio Amish Directory*, 2020 edition. Data from this directory was encoded. That included data for the mainline Old Order Amish, the New Order, the Andy Weaver group (also called the Dan Church), and the Hostetler Amish Church.
2. *History and Descendants of Peter and Elizabeth (Yoder) Hershberger, 1810–2002*. Source for Swartzentruber Amish families.
3. *The History and Genealogy of David D. Troyer and Anna Stutzman, 1813–2003*. Source for Swartzentruber Amish data, selected from personal knowledge.
4. The SAGA-OMII website of the Swiss Anabaptist Genealogical Society of Kidron, Ohio, for additional mainline Old Order Amish and Swartzentruber Amish families. This source was also used for confirming, correcting, and supplementing family information from other sources.

Table 1 shows the population sizes for affiliations, families, and church districts of the Holmes County settlement. The size of the Hostetler Amish group consists of the families from only six church districts. That is enough individuals to determine the fertility of the group and a few other values. However, the number of multiple births was too small to make meaningful analyses. The Stutzman-Troyer group consists of one district, and its numbers are too small to do meaningful analysis and even to display in Table 1.

Table 1

Affiliations, Families, and Church Districts

Amish affiliation	Total families/ households	Completed families	Number of church districts
New Order	485	260	19
Mainline Old Order	5,312	2,281	183
Andy Weaver (Dan Church)	1,108	361	40
Hostetler	172	66	6
Swartzentruber		247	

The *Ohio Amish Directory*, 2020 edition (Wengerd, 2020), contains a number of smaller outlying Amish communities, such as Lakeville, Adamsville, Tiverton, McKay, Danville, Brinkhaven, Walhonding, Glenmont, West Union, Gallipolis, and Barlow. Families from these communities were not included in this study. The main part of the Holmes County settlement used in this study included the eastern half of Holmes County, the southeastern quarter of Wayne County, a small southwestern corner of Stark County, the western strip of Tuscarawas County, and the northeastern quarter of Coshocton County. The area is represented graphically in Figure 1. This geographic area contains the mainline Old Order Amish (183 districts), the Dan Church (40 districts), the New Order Amish (19 districts), the Hostetler Amish Church (6 districts), the New New Order Amish Church (4 districts), the New Order Tobe Church (4 districts), the Stutzman-Troyer Amish Church (1 district), and the Swartzentruber Amish.

The Swartzentruber Amish Church (also called the Sam Yoder Church) does not participate in the *Ohio Amish Directory*. Data for that Amish church group were therefore obtained from other sources including *History and Descendants of Peter Hershberger and Elizabeth (Yoder) Hershberger, 1810–2002* (Miller, 2002).[1] Additional Swartzentruber Amish families were obtained from *The History and Genealogy of David D. Troyer and Anna Stutzman* (Troyer, 2003). Swartzentruber families were identified on the basis of personal knowledge. The SAGA-OMII website of the Swiss Anabaptist Genealogical Society of Kidron, Ohio, was used for additional Swartzentruber Amish families. This source was also used for confirming, correcting, and supplementing family information from other sources.

An Amish woman's reproductive span begins on the day she is married and ends at the onset of menopause or when she is no longer exposed to the risk of pregnancy, for whatever reason. The marriage date (the beginning of her reproductive span) is always a firmly established date, but the end of the span cannot be so readily established. The length of an Amish woman's reproductive span is normally somewhere between 20 and 25 years. The birth of any children will obviously occur somewhere during this reproductive span, and there is a finite number of birth events that can occur during this time period. The number of birth events that can fit into the reproductive span without any attempt to limit that number or increase the number in any way is known as natural fertility.

---

[1] With the generous assistance of Adam Hershberger of the Ohio Amish Library, Berlin, Ohio.

The twinning events in each of the Amish groups is summarized in Table 2. On the basis of previous studies, we should expect higher twinning rates among older women than among younger women. In Table 2, the twinning rates are broken out into five-year segments of women's ages.

Table 2

Twinning Rates by Affiliation

| Amish affiliation	Births	Mothers' age category					Total
		20-24.9	25-29.9	30-34.9	35-39.9	40-44.9	20-44.9
New Order	Singletons	452	630	475	308	82	1,947
	Twins	10	8	10	10	2	40
	Rate*	22.1	12.7	21.1	32.5	24.4	20.1
Mainline	Singletons	6,752	7,403	4,855	2,385	590	21,985
	Twins	168	212	148	74	16	618
	Rate*	24.3	27.8	29.6	30.1	26.4	27.3
Dan Church	Singletons	1,831	1,826	1,126	610	156	5,549
	Twins	48	59	46	20	6	179
	Rate*	25.2	31.3	39.2	31.7	37	31.3
Hostetler	Singletons	304	239	182	85	33	843
	Twins	0	6	4	6	0	16
	Rate*	0	24.5	21.5	65.9	0	18.6
Swartzentruber	Singletons	1,005	1,460	1,130	714	276	4,585
	Twins	36	46	46	24	12	164
	Rate*	34.6	30.5	39.1	32.5	41.7	34.5
Totals	Singletons	10,344	11,558	7,768	4,102	1.137	34,909
	Twins	262	331	254	134	36	1,017
	Rate*	24.7	27.8	31.7	31.6	30.7	28.3

*Rate = twin births / total births x 1,000

So far in this study, no longitudinal analyses have been performed. The mainline Old Order Amish file was the only one large enough for the data to be divided into decades for longitudinal study. All birth events of each decade were analyzed to determine any longitudinal variation in twinning frequency over time. (See Figure 3.)

Data for the U.S. White population was obtained online from the National Center for Health Statistics of the Centers for Disease Control and Prevention. Data for the White population of year 2002 was selected to compare with the Amish data.

Figure 3

Twinning Rates of the Holmes County, Ohio, Amish Compared with Rates of the U.S. White Population over One Half Century
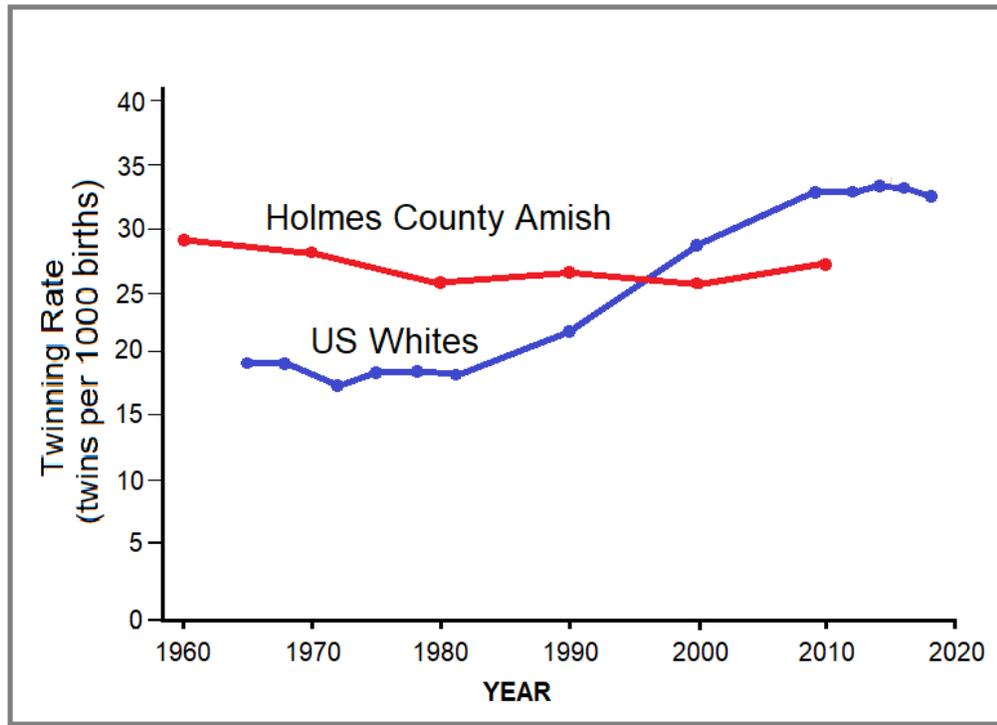
Note. Data source for U.S. White population is NCHS Natality.

Results

Overall, 7.6% of the Amish families had one pair of twins (Table 3), but a strong gradient exists from the more progressive to the more conservative Amish (from 5% to 12.5%). A similar gradient exists among the families with two pairs of twins, but with roughly 10% of the values. Five families had three pairs of twins and one family had four pairs.

Altogether, seven Amish families had triplets, although no statistical analysis could be done on this small sample.

As shown in Figure 3, the Amish twinning rate remained steady within the range of 25 to 30 twins per 1,000 since about 1960. During approximately the same period of time, the twinning rate for the U.S. White population rose from roughly 19 to 33 twins per 1,000, reflecting the dramatic rise in twinning so well documented in the literature.

The twinning rate for the New Order Amish (most progressive) group (20.1) is comparable to that of the U.S. White population before the dramatic rise in the twinning rate in the 1980s. The twinning rates of the successively more conservative Amish groups increased until it reached 34.5 twins (individuals) in the Swartzentruber (most conservative) group. Note the progression in the final column of Table 2. (The Hostetler group is too small to do any meaningful analysis).

Table 3

Twinning Characteristics of Completed Families in Five Amish Affiliations

Amish affiliation	Completed families*	Total births	No twins	Families with twins						Families with triplets	Total twins	Twins per 1,000
				1 pair		2 pairs		3 pairs	4 pairs			
				#	%	#	%	#	#			
New Order	260	1,499	246	13	5.0	1	0.38	0	0	0	15	10.0
Mainline	2,281	13,675	2,100	161	7.1	15	0.66	1	0	4	194	14.2
Dan Church	361	2,779	321	33	9.1	4	1.11	2	0	2	47	16.9
Hostetler	66	567	60	6	9.1	0	0	0	0	0	6	10.6
Swartzentruber	247	2,660	203	34	13.8	5	2.02	3	1	1	57	21.4
Total	3,215	21,180	2,930	247	7.7	25	0.78	6	1	7	319	15.1

* Completed families = mothers at least 45 years old.

Discussion

Amish Twinning Rates Not Related to U.S. Population

In the past, the twinning rate of the Amish was thought to be much higher than that of the American population. Cross and McKusick (1970) had determined the Holmes County Amish twinning rate to be 15.3 twin pairs (30.6 individuals) per 1,000 pregnancies, whereas among U.S. Whites the twinning rate was around 9 to 10 pairs of twins (18 to 20 individuals) per 1,000. Juberg (1966), while researching the genetics of the Northern Indiana Amish, determined their twinning rate to be 21.1 twin pairs per 1,000. On the basis of these studies, the Amish became known for their high twinning rates.

A decade or two after the studies of Juberg (1966) and Cross and McKusick (1970), the twinning rate of the general American population began to rise. In the three decades leading up to the year 2010, the twinning rate among the U.S. population nearly doubled (Hoekstra et al., 2008; Pison & d'Addato, 2006). This increase was accounted for primarily by two factors: delayed childbearing, as older women have twins more frequently than younger women, and the expansion of medically assisted reproduction (MAR) (Pison et al., 2015), which carries an increased probability of multiple births. This surge in twinning has now leveled off and appears to have peaked (Monden et al., 2021).

The twinning rate among the Holmes County Amish did not follow the pattern of the non-Amish American population. In fact, the Amish rate held remarkably steady, while that of the American population rose dramatically (see Figure 3). The change brought on by these two factors (age and parity) was not experienced by the Amish. The Amish do not utilize MAR technology, and the birth rates of older Amish women have not changed perceptibly during this period.

Non-Amish women who were themselves twins were at an increased risk of bearing twins (Lichtenstein et al., 1996); Bortolus et al., 1999) as were women whose close relatives had twins (Parazzini et al., 1996; Hemon et al., 1981). We have no information to determine whether Amish twins "run in the family," although considering that the Amish have large families and tend to be

highly interrelated (Kraybill et al., 2013), at some point, high consanguinity should be considered for its role in raising twinning rates.

The twinning rate always increases with mothers' age. That rate of increase is moderate for Amish women but very dramatic for American women. Compare the increase from the 20-to-25-year-old cohort to the 40-to-45-year-old cohort. In Figure 4, note that for the Amish women, that rate increased from 24.7 to 30.7, an increase of 24% (blue bars). For the non-Amish women, that rate increased from 23.0 to 66.0 or an increase of 187% (orange bars). This adds to the evidence that the Amish twinning characteristics are almost entirely independent from those of the mainstream White American population.

Figure 4

Twinning Rates of the Holmes County Amish Compared with Rates of the U.S. White Population
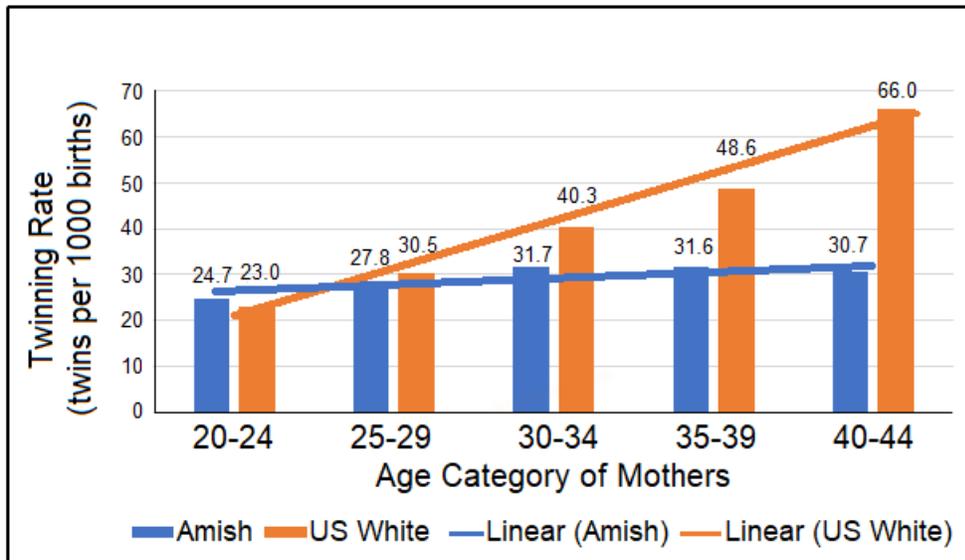
Note. Data source for U.S. Whites is NCHS Natality.

Conservatives Have More Twins than Progressives

Thus far, the conclusion from the results in Table 2 is that the Amish twinning rate has not changed for at least a half century. However, that observation hides the fact that within the different Amish groups are significant differences. The first observation is that the variances among the Amish sects are linearly progressive and appear to correlate with the degree of conservatism, suggesting that they are not simply random, hidden in and among the elements of conservatism. Since all the Amish have much history and culture in common, we would expect to see few disparities among the Amish affiliations, but significant differences in twinning rates do exist.

Different Amish groups isolate themselves from the American public to various degrees. The progressive Amish have a considerable amount of freedom to interact with the American public,[2]

---

[2] This would include shopping in non-Amish stores, working in factories, attending public gatherings like public auctions, hiring non-Amish car drivers for transportation, and reading books and magazines. The

whereas the more conservative Amish more strictly limit outside exposure. The more they mingle with non-Amish, the more they risk absorbing non-Amish values—subtle values that affect demographic behavior and twinning.

Although the Amish, especially the more progressive ones, have significant commercial interaction with mainstream American society and frequent interaction with their non-Amish neighbors, their marriage patterns are strictly endogamous, and there are few converts to the Amish faith. Hence, demographic differences with the non-Amish should not be surprising. But the differences in and among the five Amish groups themselves might be surprising because their common European history and shared American experience rules out numerous genetic, social, and cultural factors that might otherwise have influenced their twinning rates. On that basis, one might expect only minimal differences in their twinning rates.

So, if there are noticeable differences in the twinning rates among the Amish groups, despite so much common history and culture, there must be a narrow set of factors to explain the findings from this study.

Numerous social, genetic, and physical factors have been identified that influence the human twinning rate. More twins are born to taller women and women with a high body mass index (greater than 30) (Reddy, 2006; Steinman, 2006b) and to women in robust physical condition (Robson & Smith, 2011) Even family income affects twinning rates (Lummaa et al., 1998). There is no evidence that women from the more conservative Amish groups are any more robust than other Amish women. It is difficult to see how any of these factors help explain differences in twinning rates among the Amish groups.

Practically all Amish people can trace their lineage back to about 500 founding families. Their marriage pattern is strictly endogamous, and there are few converts to the Amish faith. Large families and rapid population growth within those confines result in high consanguinity of marriage partners. It is conceivable that differences in the degree of inbreeding would result in differences in twinning. Yet, Agarwala et al. (2001) could find no association between inbreeding and twinning among North American Anabaptist groups.

A former member of the Swartzentruber group has told the author that the Swartzentruber Amish eat more meat and dairy products than other Amish people (see also McConnell & Loveless, 2018, pp. 52–53). That difference could provide a hint that the twinning differences between the progressive and conservative Amish sects are due to dietary factors. Milk contains a variable amount of estrogen (Pape-Zambito, 2010), which could conceivably affect monthly ovulation depending on the actual estrogen concentration and the amount of milk consumed. Another study showed that meat consumption has a profound effect on twinning rates (Steinman, 2006a).

It seems possible, therefore, that different dietary practices have followed the progressive-conservative continuum and are responsible for—or at least a contributing factor to—the observed intra-Amish twinning variances.

Swartzentruber Amish restrict reading matter. They ride in cars only in emergencies or with permission from the church. No such restrictions exist among the more progressive groups of Amish.

Conclusion

Given the surprising variations in twinning among different affiliations of Holmes County Amish, it becomes imperative that this study be replicated from demographic datasets of the Amish population in other localities. Especially, it would be interesting to ascertain the twinning rate in Swiss-Amish communities, and to compare twinning rates among communities located in other states and Canadian provinces. As well, if larger families are expected among more conservative Amish, it means that their reproductive span is longer, with more conservative women bearing children at later stages than women from more progressive groups. Since there is a correlation between age and twinning, it may help account for at least some of the differences. Additional research on twinning may determine more precisely the reasons for intra-Amish differences.

References

Agarwala R., Schäffer, A. A., & Tomlin, J. F. (2001). Towards a complete North American Anabaptist genealogy II: Analysis of inbreeding. *Human Biology*, *73*(4), 533–545. https://doi.org/10.1353/hub.2001.0045

Beemsterboer, S. N., Homburg R., Gorter, N. A., Schats, R., Hompes, P. G. A., & Lambalk, C. B. (2006). The paradox of declining fertility but increasing twinning rates with advancing maternal age. *Human Reproduction*, *21*(6), 1531–1532. https://doi.org/10.1093/humrep/del009

Bortolus, R., Parazzini, F., Chatenoud, L., Benzi, G., Bainchi, M. M., & Marini, A. (1999). The epidemiology of multiple births. *Human Reproduction Update, 5*(2), 179–187. https://doi.org/10.1093/humupd/5.2.179

Cross, H. E., & McKusick, V. A. (1970). Amish demography. *Social Biology*, *17*(2), 83–101. https://doi.org/10.1080/19485565.1970.9987850

Hemon, D., Berger, C., & Lazar, P. (1981). Twinning following oral contraceptive discontinuation. *International Journal of Epidemiology*, *10*(4), 319–328. https://doi.org/10.1093/ije/10.4.319

Hoekstra, C., Zhao, Z. Z., Lambalk, C. B., Willemsen, G., Martin, N. G., Boomsma, D. I., & Montgomery, G. W. (2008). Dizygotic twinning. *Human Reproduction Update*, *14*(1), 37–47. https://doi.org/10.1093/humupd/dmm036

Juberg, R. C. (1966). *Selection in the ABO, Rhesus, and MNSs blood group polymorphisms in an Amish isolate of northern Indiana* (Publication No. 6708284) [Doctoral dissertation, University of Michigan]. ProQuest Dissertations Publishing.

Kraybill, D. B., Johnson-Weiner, K. M., & Nolt, S. M. (2013). *The Amish*. Johns Hopkins University Press.

Lichtenstein, P., Olausson, P. O., & Kallen, A. J. B. (1996). Twin births to mothers who are twins: A registry-based study. *British Medical Journal, 312*, 879–881. https://doi.org/10.1136/bmj.312.7035.879

Lummaa, V., Haukioja, E., Lemmetyinen, R., & Pikkola, M. (1998). Natural selection on human twinning. *Nature*, *394*, 533–534. https://doi.org/10.1038/28977

McConnell, D. L., & Loveless, M. D. (2018). *Nature and the environment*. Johns Hopkins University Press.

Miller, D., comp. (2002). *History and descendants of Peter and Elizabeth (Yoder) Hershberger, 1810–2002*. Carlisle Printing.

Monden, C., Pison, G., & Smits, J. (2021). Twin peaks: More twinning in humans than ever before. *Human Reproduction*, *36*(6), 1666–1673. https://doi.org/10.1093/humrep/deab029

Pape-Zambito, D. A., Roberts, R. F., & Kensinger, R. S. (2010). Estrone and 17β-estradiol concentrations in pasteurized-homogenized milk and commercial dairy products. *Journal of Dairy Science*, *93*(6), 2533–2540. https://doi.org/10.3168/jds.2009-2947

Parazzini, F., Chatenoud, L., Benzi G., Di Centio, E., Dal Pino, D., Tozzi, L., & Fedele, L. (1996). Pregnancy: Coffee and alcohol intake, smoking and risk of multiple pregnancy. *Human Reproduction*, *11*(10), 2306–2309. https://doi.org/10.1093/oxfordjournals.humrep.a019094

Pison, G., & d'Addato, A. V. (2006). Frequency of twin births in developed countries. *Twin Research and Human Genetics*, *9*(2), 250–259. https://doi.org/10.1375/twin.9.2.250

Pison, G., Monden, C. W. S., & Smits, J. (2015). Twinning rates in developed countries: Trends and explanations. *Population and Development Review*, *41*(4), 629–649. https://doi.org/10.1111/j.1728-4457.2015.00088.x

Reddy, U. M., Branum, A. M., & Klebanoff, M. A. (2005). Relationship of maternal body mass index and height to twinning. *Obstetrics and Gynecology*, *105*(3), 593–597. https://doi.org/10.1097/01.AOG.0000153491.09525.dd

Robson, S. L., & Smith, K. R. (2011). Twinning in humans: Maternal heterogeneity in reproduction and survival. *Proceedings of the Royal Society B: Biological Sciences*, *278*(1725), 3755–3761. https://doi.org/10.1098/rspb.2011.0573

Smith, E. (1960). *Studies in Amish demography*. The Research Council, Eastern Mennonite College.

Steinman, G. (2006a). Mechanisms of twinning: VII. Effect of diet and heredity on the human twinning rate. *Journal of Reproductive Medicine*, *51*(5), 405–410.

Steinman, G. (2006b). Mechanisms of twinning: VIII. Maternal height, insulinlike growth factor and twinning rate. *Journal of Reproductive Medicine*, *51*(9), 694–698.

Troyer, H., comp. (2003). *The history and genealogy of David D. Troyer and Anna Stutzman, 1813–2003*. Henry Troyer.

Wengerd, M., comp. (2020). *Ohio Amish directory: Holmes County and vicinity, 2020*. Carlisle Press.

Zimmer, Z., Hanson, H. A., & Smith, K. R. (2016). Offspring socioeconomic status and parent mortality within a historical population. *Demography*, *53*(5), 1583–1603. https://doi.org/10.1007/s13524-016-0502-x