CHILD DEVELOPMENT PERSPECTIVES

Early Findings From the TransYouth Project: Gender Development in Transgender Children

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ABSTRACT—***Despite a dramatic increase in the number of socially transitioned transgender children (children who identify with the gender opposite their natal sex and who change their appearance and pronouns to align with that gender identity), few studies have examined transgender children's gender development. Findings from the TransYouth Project, the first large, longitudinal study of socially transitioned transgender children, suggest that the gender development of socially transitioned children looks similar to the gender development of their gender-typical, gender-matched peers and gender-typical siblings. In this article, we review findings from the few studies that have addressed this topic, connect these studies to past research, and discuss ways to foster deeper understanding of gender development among transgender children.***

KEYWORDS—*gender development; transgender children; identity*

In 2007, Barbara Walters interviewed 6-year-old Jazz Jennings, perhaps the first openly transgender child on American network television (1). Jazz's story was notable not because she was transgender—a natal[1] male who identified as a girl—but because her parents had permitted her to transition socially (i.e., she was referred to as a girl and by the pronoun *she* rather than a boy who used the pronoun *he*; no hormonal or surgical interventions were involved). Since then, articles about socially transitioned transgender children have appeared in popular media (2–4), and clinics that focus on gender development in children have reported a surge in the number of children who transition socially (5). Despite these increases, until 2 years ago, no quantitative research had been reported on the development of these children. In this article, we review research on gender development in transgender children who have transitioned socially, note connections to past research on gender-nonconforming children (i.e., children who have preferences and interests more common for children of the opposite sex but are not necessarily transgender and have not transitioned socially), and outline avenues for work in this area.[2]

THE TRANSYOUTH PROJECT

To our knowledge, only one laboratory has begun investigating gender development in socially transitioned children. The TransYouth Project (TYP) is a longitudinal study of gender development among socially transitioned prepubescent transgender children (ages 3–12 years at the start of the study in 2013) from North America. Families are recruited into the study via online and in-person support groups and conferences for families with transgender children, via referrals from clinicians, by

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[1]Although it is more acceptable in transgender communities to use the terms *assigned sex at birth*, *assigned male at birth*, and *assigned female at birth*, in this article we use the terms *natal sex*, *natal male*, and *natal female* to refer to the sex of the child at birth for ease of comprehension, and because terms like *assigned sex at birth* can lead to confusion between transgender children and children who are intersex (those whose sex cannot be easily labeled male or female at birth).

[2]Gender is often conceptualized as a spectrum or even a multidimensional space. Nonetheless, for ease of communication and because the children referred to in this article see their gender as discrete and binary, we use the term *opposite gender*. Thus, a child like Jazz is a girl according to her gender identity and this is the *opposite* of the sex she was assigned at birth (male).

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word of mouth, and in response to media coverage of the project. Since these children transitioned socially, and doing so at a young age requires parents' approval, the children in this study have much parental support of their gender identities (even if support varied earlier in their lives). Given these sampling approaches, caution is warranted in generalizing the findings beyond groups of children who share these characteristics.

The TYP also includes two comparison groups. The first is a group of unrelated, gender-typical children matched for age and gender with the transgender children (e.g., a trans girl like Jazz would be paired with a gender-typical girl; we use the term *typical* to refer to youth who demonstrate the modal, or most common, pattern of gender development; our use of this term should not imply that such development is prescriptively better or worse). The second comparison group is siblings of the transgender participants, who have close contact with and knowledge about gender diversity but are not transgender.

Three studies explore gender development in the TYP cohort. One (6) reported on 32 (M = 9.1 years) transgender elementary school-age children, another (7) reported on 36 transgender preschool-age children (M = 5.0 years), and a third (8) reported on 56 transgender elementary school-age children (M = 7.5 years). In all studies, more than half of the transgender children identified as girls (63, 78, and 75%, respectively) and researchers focused on four constructs in gender development: gender identity, gender-stereotypic preferences, gender stereotyping, and gender constancy.

This work was exploratory because all outcomes were possible theoretically. Because transgender children live for some time as members of one group before being recognized as members of the opposite group, we hypothesized that transgender children could have one of three outcomes: they could respond in ways that are less gendered than their gender-matched peers (perhaps as a result of the lasting impact of that early socialization), they could assert their identities and beliefs even more than their gender-matched peers (perhaps to "prove" their gender identity), or they could not differ from their gender-matched peers.

Gender Identity

Most gender-typical children reliably identify their gender by their third birthday (9). In studies of 3- to 12-year-olds, most gender-typical children identify with their gender and do so more strongly than with the opposite gender (10). In all studies of socially transitioned transgender children that have assessed gender identity, transgender children as young as age 3 have identified clearly and consistently with their current gender, and indicated feeling more similar to peers of their own gender and dissimilar to peers of the opposite gender (the magnitude of these effects does not differ from their gender- and age-matched peers; 6, 7). Furthermore, elementary school-aged transgender and gender-typical children also show equally strong implicit gender identification as measured by the Gender Identity Implicit Association Test, a more implicit or automatic assessment of gender identity (6).

Gender-Stereotypic Preferences

Another clear hallmark of early gender development in gender-typical children is that they often show robust and reliable gender-typed preferences (11, 12). For example, boys tend to prefer being friends with other boys, as well as playing with toys and wearing clothes that are marketed toward boys (13, 14). In the TYP, during the preschool years, transgender children preferred toys, clothing, and playmates, and wore clothing typically associated with their gender (not their natal sex) at the same rates as gender-matched children (7). Elementary school-aged transgender children preferred peers of their gender, chose to play with novel toys endorsed by peers of their gender, and implicitly preferred their gender (i.e., they associated their gender with *good* and the opposite gender with *bad*; 6). Together, across measures and ages, the findings for preferences are clear: Socially transitioned transgender children show the same gender-stereotypical preferences in direction and magnitude as unrelated children and siblings of the same gender (6, 7).

Gender Stereotyping

Gender-typical children endorse common gender stereotypes (e.g., girls have long hair or boys do not wear dresses) by ages 3–4 (for reviews, see 15, 16) and negatively evaluate peers who violate these gender stereotypes (17, 18). While endorsing gender stereotypes peaks around age 6 and then begins to decline (19), even adolescents and adults endorse many gender stereotypes (20, 21) and discriminate against people who violate those stereotypes (22–24).

Unlike findings in the domains of identity and preferences, transgender children in the TYP differed from children in the control group in gender stereotyping, at least in the elementary years. At ages 3–5, socially transitioned transgender children did not differ significantly from unrelated children or siblings in their level of endorsing stereotypes, though at the mean level, transgender children and siblings endorsed gender stereotypes less than unrelated children in the control group (7); at ages 6–8, this difference was significant. Transgender children and their siblings were significantly less likely to endorse gender stereotypes than unrelated children, and they believed that gender nonconformity in peers was more acceptable than unrelated children did (8). By this age, transgender children and their siblings were also more willing to befriend gender-nonconforming peers than unrelated children were. We do not know whether these group differences are related to different interpersonal experiences (e.g., more exposure to gender-nonconforming children), different socialization (e.g., parents may talk about gender differently), or some combination of these factors. Nor do we know whether the developmental difference between groups can be explained by the smaller sample size of the preschool group or real developmental change (see 8 for a more detailed

discussion). Efforts to replicate this work should address these questions.

Gender Constancy

Gender constancy, or the belief that gender is stable across time and consistent across situations, has long been a cornerstone of research on gender development (25). Achieving gender constancy has been viewed as a necessary milestone for young children and critical to learning gender roles (26). In studies of gender-typical children, by age 5, children believe gender is stable across development, and by age 7, they believe gender is consistent across changes in situation (e.g., changing clothes; 27).

Researchers have explored gender constancy only in preschool-aged transgender children (7). On a traditional gender-constancy task (e.g., asking whether a participant will grow up to be a man or a woman; 28), transgender children overwhelmingly indicated that they would remain a member of their current gender group as adults at the same rates as children in the comparison groups. However, when asked about their gender as infants, transgender children differed from children in the comparison groups: Most indicated that they were members of the opposite-gender group in infancy (i.e., they answered in a way that aligned with their sex at birth).

Children in the TYP were also asked about the stability of other people's gender across time. Children in all groups believed that most people's gender would be stable across time (i.e., most boys would grow up to be men). However, whereas children in the unrelated control group said they always believed that gender was stable, transgender children and their siblings said they believed that occasionally, a person's gender would not remain stable from childhood into adulthood. The responses by all children in all groups about the consistency of gender across situational changes—for both themselves and others—did not differ from chance, consistent with past work with children at this age (29).

Why did the transgender children indicate that their gender had changed since infancy? One possibility is that transgender children often hear that they were previously a different gender (e.g., "you were born a boy") and know they are no longer living as that gender, so they perceive this as a change, or that they confused the concepts of sex and gender. Another possibility is that transgender children reported on a change they felt, moving from one gender to its opposite. Yet another possibility—consistent with the chance results on the third-party consistency measures for all groups—is that transgender children, like all children at this age, are confused by stories involving changes in clothing, and know they used to dress as one gender and now dress as the opposite gender. Additional research is needed to understand how children reason about these questions, especially as society moves forward and children without transgender siblings are exposed to transgender or gender-nonconforming people.

LIMITS, RELATED RESEARCH, AND NEXT STEPS

The findings of the TYP are limited in several ways. First and foremost, they come from a single large-scale study whose sample is limited in many ways (e.g., predominantly White, of higher socioeconomic status, and higher parental educational status than the average child). Because of challenges recruiting socially transitioned children, samples are relatively small, are skewed toward more supportive families, and have biases associated with community recruitment (e.g., parents are likely more supportive of scientific research, members of groups treated poorly by researchers in the past are probably underrepresented). Furthermore, because the children in these studies have transitioned socially before participating, we do not know if the findings are a result of children's social transitions or reflect responses that would have been noted before their transitions. Nonetheless, these first quantitative studies of gender development in young socially transitioned transgender children have yielded the same results across conceptually related measures, suggesting that the findings are robust, at least among groups of children with similar sample biases.

Although the research we have presented is the first to investigate development among socially transitioned transgender children, older and more clinically focused research has reported on gender development among a related group of children similar in some respects to the children in the TYP. In past studies, children were referred to clinics for behaving in gender-nonconforming ways that were associated culturally with the opposite sex (e.g., boys who wanted to wear dresses and heels, girls who expressed an interest in growing up to be men), but they had not transitioned socially (i.e., they lived as the gender associated with their sex at birth). The children in these studies from decades ago also differed in many other ways: For example, they were recruited through clinics so they may have had health problems, they lived in different countries (e.g., Canada, the Netherlands), and the participants were more socioeconomically diverse than children in the TYP moreover, the studies were run by the same teams that evaluated and treated the children (for more information on differences, see 30). Despite these differences, findings from prior studies are relevant to current work because they involved children at the same ages who were notable to the adults around them for their less-common gender development.

Many of the findings from the clinic-based studies of gender-nonconforming children, especially in the domain of preferences, align with the recent findings. For example, the clinic-referred children preferred playmates, toys, and play styles associated stereotypically with the opposite sex more often than their same-sex peers (31–36), like the socially transitioned transgender children in the TYP (in fact, the TYP children showed effects that were equal in magnitude to opposite-sex gender-typical peers; 6, 7). The children in the older studies also endorsed beliefs about gender stability at lower levels than

gender-typical children in the control group, consistent with findings related to transgender children who have transitioned socially (37).

While many of the findings from these past and current studies are similar, one striking dissimilarity involves a measure of gender identity. Fewer than 10% of children in the older studies identified as the gender opposite their sex at birth when asked if they were boys or girls (37, 38). This contrasts with most children in the TYP, who report being a member of the gender group opposite their sex at birth. We do not know whether this difference is attributable to differences in recruitment techniques, measures, the fact that the TYP children had transitioned socially, demographic differences, or other factors.

In addition to the older studies just described, researchers have examined girls with minor deviations in gender nonconformity—often called tomboys. These children often self-identify and are recruited from largely normative or more representative samples. While tomboys differ from their female peers in their stronger interest in stereotypically masculine activities, they do not differ from their female peers in their interest in stereotypically feminine activities (39, 40), suggesting that we should categorize self-identified tomboys as androgynous, or having high levels of both femininity and masculinity (see also 10). In this way, tomboys also appear to be less "extreme" in the degree to which they prefer and associate with things traditionally associated with the opposite sex than the children in the older studies and those in the TYP.

Researchers need to bridge the gaps between these disparate studies by measuring children recruited through diverse means using similar tools. Gender nonconformity is likely continuous rather than categorical, and researchers could benefit from understanding the developmental course of children with different degrees of gender nonconformity. If gender-nonconforming children can be identified early and studied longitudinally, researchers could investigate such issues as whether cross-gender identification emerges before or after social transitions and whether some degrees of gender nonconformity are more or less likely to fade or change over time (32, 41, 42). Furthermore, by studying a large and diverse group of gender-nonconforming children over time, researchers can understand more fully the relationships between different aspects of gender development (e.g., preferences, identity), identifying key signatures that might inform which (if any) children would benefit from social transitions or other early supports. Toward this end, researchers should recruit large and diverse groups of children and track their development to expand our understanding about gender diversity as well as gender development more broadly.

CONCLUSION

Early results from the TYP suggest that socially transitioned transgender children resemble gender-matched children in their gender identities and gender expression. Transgender girls like Jazz identify as girls and prefer girl-typed toys and clothes as much as other girls, and transgender boys show patterns indistinguishable from other boys on these measures. At the same time, compared to gender-typical children, transgender children and their siblings are apparently less likely to stereotype according to gender and more likely to tolerate gender nonconformity in others, and they believe that others' gender experience varies (e.g., seeing some people's gender as changing across the lifespan). The similarity between transgender children and their siblings on their views of gender suggests that one need not be transgender to think about gender flexibly. More research is needed, especially studies that address questions related to the diversity of children who display less common patterns of gender development in early childhood.

REFERENCES

1. Goldberg, A. B., & Adriano, J. (2007, April 27). "I'm a girl"–Understanding transgender children. *ABC News*. Retrieved from http://abcnews.go.com/2020/story?id=3088298&page=1
2. Nicholson, K. (2013, June 24). Coy Mathis' family celebrates civil rights win for transgender child. *Denver Post*. Retrieved from http://www.denverpost.com/ci_23529796/coymathis-family-celebrates-civil-rightswin-transgender.
3. Sulek, J. (2017, May 2). Transgender grandchild: Rep. Mike Honda says 8-year-old's gender change not a phase. *San Jose Mercury News*. Retrieved from http://www.mercurynews.com/bayarea-news/ci_27559981/transgendergrandchild-congressman-mike-hondasays-8-year
4. Wallace, K. (2015, June 2). When your young daughter says "I'm a boy." *CNN*. Retrieved from http://www.cnn.com/2015/03/18/living/feat-transgender-childraising-ryland
5. Steensma, T. D., & Cohen-Kettenis, P. T. (2011). Gender transitioning before puberty? *Archives of Sexual Behavior*, *40*, 649–650. https://doi.org/10.1007/s10508-011-9752-2
6. Olson, K. R., Key, A. C., & Eaton, N. R. (2015). Gender cognition in transgender children. *Psychological Science*, *26*, 467–474. https://doi.org/10.1177/0956797614568156
7. Fast, A. A., & Olson, K. R. (2017). Gender development in preschool transgender children. *Child Development*. https://doi.org/10.1111/cdev.12758
8. Olson, K. R., & Enright, E. A. (2017). Do transgender children (gender) stereotype less than their peers and siblings? *Developmental Science*. https://doi.org/10.1111/desc.12606
9. Leinbach, M. D., & Fagot, B. I. (1986). Acquisition of gender labels: A test for toddlers. *Sex Roles*, *15*, 655–666. https://doi.org/10.1007/BF00288221
10. Martin, C. L., Andrews, N. C. Z., England, D. E., Zosuls, K., & Ruble, D. N. (2016). A dual identity approach for conceptualizing and measuring children's gender identity. *Child Development*, *88*, 167–182. https://doi.org/10.1111/cdev.12568
11. Serbin, L. A., Poulin-Dubois, D., Colburne, K. A., Sen, M. G., & Eichstedt, J. A. (2001). Gender stereotyping in infancy: Visual preferences for and knowledge of gender-stereotyped toys in the second year. *International Journal of Behavioral Development*, *25*, 7–15. https://doi.org/10.1080/01650250042000078
12. Zosuls, K. M., Ruble, D. N., Tamis-LeMonda, C. S., Shrout, P. E., Bornstein, M. H., & Greulich, F. K. (2009). The acquisition of

gender labels in infancy: Implications for gender-typed play. *Developmental Psychology*, *45*, 688–701. https://doi.org/10.1037/a0014053
13. Martin, C. L., & Fabes, R. A. (2001). The stability and consequences of young children's same sex peer interactions. *Developmental Psychology*, *37*, 431–446. https://doi.org/10.1037//0012-1649.37.3.431
14. Shutts, K., Pemberton, C. K., & Spelke, E. S. (2013). Children's use of social categories in thinking about people and social relationships. *Journal of Cognition and Development*, *14*, 35–62. https://doi.org/10.1080/15248372.2011.638686
15. Ruble, D. N., & Martin, C. L. (1998). Gender development. In W. Damon, R. M. Lerner, & N. Eisenberg (Eds.), *Handbook of child psychology: Social, emotional, and personality development* (Vol. 3, pp. 933–1016). Hoboken, NJ: Wiley.
16. Signorella, M. L., Bigler, R. S., & Liben, L. S. (1993). Developmental differences in children's gender schemata about others: A meta-analytic review. *Developmental Review*, *13*, 147–183. https://doi.org/10.1006/drev.1993.1007
17. Blakemore, J. E. O. (2003). Children's beliefs about violating gender norms: Boys shouldn't look like girls, and girls shouldn't act like boys. *Sex Roles*, *48*, 411–419. https://doi.org/10.1023/A:1023574427720
18. Martin, C. L. (1989). Children's use of gender-related information in making social judgments. *Developmental Psychology*, *25*, 80–88. https://doi.org/10.1037/0012-1649.25.1.80
19. Trautner, H. M., Ruble, D. N., Cyphers, L., Kirsten, B., Behrendt, R., & Hartmann, P. (2005). Rigidity and flexibility of gender stereotypes in childhood: Developmental or differential? *Infant and Child Development*, *14*, 365–381. https://doi.org/10.1002/icd.399
20. Alfieri, T., Ruble, D. N., & Higgins, E. T. (1996). Gender stereotypes during adolescence: Developmental changes and the transition to junior high school. *Developmental Psychology*, *32*, 1129–1137. https://doi.org/10.1037/0012-1649.32.6.1129
21. Eagly, A. H., & Mladinic, A. (1989). Gender stereotypes and attitudes toward women and men. *Personality and Social Psychology Bulletin*, *15*, 543–558. https://doi.org/10.1177/0146167289154008
22. Rudman, L. A., & Glick, P. (2001). Prescriptive gender stereotypes and backlash toward agentic women. *Journal of Social Issues*, *57*, 743–762. https://doi.org/10.1111/0022-4537.00239
23. Rudman, L. A., & Glick, P. (1999). Feminized management and backlash toward agentic women: The hidden costs to women of a kinder, gentler image of middle managers. *Journal of Personality and Social Psychology*, *77*, 1004–1010. https://doi.org/10.1037/0022-3514.77.5.1004
24. Rudman, L. A., & Fairchild, K. (2004). Reactions to counterstereotypic behavior: The role of backlash in cultural stereotype maintenance. *Journal of Personality and Social Psychology*, *87*, 157–176. https://doi.org/10.1037/0022-3514.87.2.157-176
25. Kohlberg, L. (1966). A cognitive-developmental analysis of children's sex-role concepts and attitudes. In E. E. Maccoby (Ed.), *The development of sex differences* (pp. 82–173). Stanford, CA: Stanford University Press.
26. Ruble, D. N., Balaban, T., & Cooper, J. (1981). Gender constancy and the effects of sex-typed televised toy commercials. *Child Development*, *52*, 667–673. https://doi.org/10.2307/1129188
27. Martin, C. L., Ruble, D. N., & Szkrybalo, J. (2002). Cognitive theories of early gender development. *Psychological Bulletin*, *128*, 903–933. https://doi.org/10.1037/0033-2909.128.6.903
28. Slaby, R. G., & Frey, K. S. (1975). Development of gender constancy and selective attention to same-sex models. *Child Development*, *46*, 849–856. https://doi.org/10.2307/1128389
29. Ruble, D. N., Taylor, L. J., Cyphers, L., Greulich, F. K., Lurye, L. E., & Shrout, P. E. (2007). The role of gender constancy in early gender development. *Child Development*, *78*, 1121–1136. https://doi.org/10.1111/j.1467-8624.2007.01056.x
30. Olson, K. R. (2016). Prepubescent transgender children: What we do and do not know. *Journal of the American Academy of Child and Adolescent Psychiatry*, *55*, 155–156.e3. https://doi.org/10.1016/j.jaac.2015.11.015
31. Fridell, S. R., Owen-Anderson, A., Johnson, L. L., Bradley, S. J., & Zucker, K. J. (2006). The playmate and play style preferences structured interview: A comparison of children with gender identity disorder and controls. *Archives of Sexual Behavior*, *35*, 729–737. https://doi.org/10.1007/s10508-006-9085-8
32. Zucker, K. J., Bradley, S. J., Doering, R. W., & Lozinski, J. A. (1985). Sex-typed behavior in cross-gender-identified children: Stability and change at a one-year follow-up. *Journal of the American Academy of Child Psychiatry*, *24*, 710–719. https://doi.org/10.1016/S0002-7138(10)60114-8
33. Doering, R. W., Zucker, K. J., Bradley, S. J., & MacIntyre, R. B. (1989). The effects of neutral toys and sex-typed play in children with gender identity disorder. *Journal of Abnormal Child Psychology*, *27*, 563–574.
34. Green, R., Fuller, M., Rutley, B. R., & Hendler, J. (1972). Playroom toy preferences of fifteen masculine and fifteen feminine boys. *Behavior Therapy*, *3*, 425–429. https://doi.org/10.1016/S0005-7894(72)80142-4
35. Rekers, G. A., & Yates, C. E. (1976). Sex-typed play in feminoid boys versus normal boys and girls. *Journal of Abnormal Child Psychology*, *4*, 1–8. https://doi.org/10.1007/BF00917600
36. Zucker, K. J., Doering, R. W., Bradley, S. J., & Finegan, J. K. (1982). Sex-typed play in gender-disturbed children: A comparison to sibling and psychiatric controls. *Archives of Sexual Behavior*, *11*, 309–321. https://doi.org/10.1007/BF01541592
37. Zucker, K. J., Bradley, S. J., Kuksis, M., Pecore, K., Birkenfeld-Adams, A., Doering, R. W., … Wild, J. (1999). Gender constancy judgments in children with gender identity disorder: Evidence for a developmental lag. *Archives of Sexual Behavior*, *28*, 475–502. https://doi.org/10.1023/A:1018713115866
38. Wallien, M. S., Quilty, L. C., Steensma, T. D., Singh, D., Lambert, S. L., Leroux, A., … Zucker, K. J. (2009). Cross-national replication of the gender identity interview for children. *Journal of Personality Assessment*, *91*, 545–552. https://doi.org/10.1080/00223890903228463
39. Plumb, P., & Cowan, G. (1984). A developmental study of destereotyping and androgynous activity preferences of tomboys, nontomboys, and males. *Sex Roles*, *10*, 703–712.
40. Martin, C. L., & Dinella, L. M. (2012). Congruence between gender stereotypes and activity preference in self-identified tomboys and non-tomboys. *Archives of Sexual Behavior*, *41*, 599–610. https://doi.org/10.1007/s10508-011-9786-5
41. Steensma, T. D., Biemond, R., de Boer, F., & Cohen-Kettenis, P. T. (2011). Desisting and persisting gender dysphoria after childhood: A qualitative follow-up study. *Clinical Child Psychology and Psychiatry*, *16*, 499–516. https://doi.org/10.1177/1359104510378303
42. Steensma, T. D., McGuire, J. K., Kreukels, B. P., Beekman, A. J., & Cohen-Kettenis, P. T. (2013). Factors associated with desistence and persistence of childhood gender dysphoria: A quantitative follow-up study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *52*, 582–590. https://doi.org/10.1016/j.jaac.2013.03.016