ARTICLE

B'rit shalom: a Jewish ritual alternative to newborn male circumcision

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This paper focuses on the ritual *b'rit shalom* (also *brit shalom*), Hebrew for "covenant of peace," which is intentionally positioned as an alternative to *b'rit milah*, the covenant of circumcision, for infant males. Although *b'rit shalom* is currently not common in the Jewish community, it might well become more popular. The first section discusses some of the history and practices of *b'rit milah*, so that the second section can better show the development and potential of *b'rit shalom*. Since many Americans, including Jews, no longer view circumcision as a cultural necessity, and there is long-running ethical debate about infant male genital cutting, there is reason to explore Jewish infant rituals which do not include circumcision.

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Among Jews today, both *b'rit milah*, i.e., infant male ritual circumcision (also called a *bris*), and circumcision in the hospital remain common. (Data are sparse about exactly how common these practices are. All that is clear is that a vast majority of Jewish males undergo infant circumcision, in both the United States and Israel.) It is not always recognized that these alternatives are distinct; although Jewish religious authorities tend to prefer hospital circumcision to none at all [1], hospital circumcision in some ways rejects the traditional practice of ritual circumcision. Given that only 35% of American Jews affiliate with a synagogue or share a household with someone who does, and only 15% of American Jews consider Jewish law central to their own conception of being Jewish [2], pp 57, 20], many Jews unsurprisingly eschew a ritual context for their male babies' circumcision [3]. Nevertheless, there are complex historical, social, and cultural reasons why circumcision has remained so popular [4–11].

However, circumcision is not a given among the broader American population. Although up-to-date data are sparse, 58.3% of male babies were circumcised in the hospital in 2010, and around 70–80% of the US male population is circumcised [12, 13]. Many Americans, including Jews, no longer view circumcision as a cultural necessity. Further, there is long-running ethical debate about infant male genital cutting [14, 15]. In this context, in which many Jews already do not participate in traditional *b'rit milah* and infant circumcision is not automatic, there is reason to explore Jewish infant rituals which do not include circumcision.

This paper will focus on the most prominent such ritual, *b'rit shalom* (also *brit shalom*), Hebrew for "covenant of peace," which is intentionally positioned as an alternative to *b'rit milah*, the covenant of circumcision, for infant males. Although the term *b'rit shalom* first appears in the Torah (Numbers 25:12), it has only been applied to a ceremony for an infant over the last couple decades. This paper aims to shed light on *b'rit shalom* as a Jewish, non-circumcising alternative to *b'rit milah*. Although *b'rit shalom* is currently not so common in the Jewish community, it might well become more popular. The first section will discuss some of the history and practices of *b'rit milah*, so that the second section can better show the development and potential of *b'rit shalom*.

B'RIT MILAH

Circumcision in Jewish tradition stems from the Torah, in which Abraham circumcises himself and his sons and the practice is commanded for his infant males and their descendants (Genesis 17, 21:4; Leviticus 12:3). Circumcision has many layers of meaning, including in its biblical depictions, which are beyond the scope of this paper [6–8]. (One other issue is whether circumcision is the same covenant which God makes with all Jews, or whether it is a separate one with only males.) For our purposes, what matters is that circumcision is viewed as central by many Jews. Here are representative accounts of how circumcision is supposed to preserve Jewish tradition, offered by major thinkers from the two biggest American Jewish denominations:

> Circumcision is a tribal rite in the same way that every Jewish ritual observance is a "tribal rite": a means by which the members of our "tribe" express their identity as a people, as a community covenanted with God, through the performance of a "rite" meaningful only within the context of that covenant… Every tribe in the world behaves in this way, proclaiming its sense of community through the performance of rituals that allow the tribe to tell its story and to recount its sense of self. And make no mistake: we Jews are a "tribe," a social grouping that has defined its existence and historical destiny as that of a family… [16].

> Yet this painful (for the parents as much as for the infant) ritual of devotion has also become a defining act of defiance against the larger culture, a bold and brave declaration of Jewish identity, a dramatic commitment of each generation to confirm

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> its ancient covenant…. This ritual is therefore not an obsequious surrender of agency, but a heroic assertion [17].

The question then arises: why do this covenant, this struggle against the larger culture, and this tribe rely on circumcision itself, rather than on Jewish ritual observance overall? It is certainly correct that many have attempted to ban and stigmatize circumcision, even until today [18, 19]. Yet it is not clear that circumcision represents anything particularly Jewish among the many circumcised Jews with little to no religious connection. Our discussion will show that *b'rit shalom* can satisfy these demands for Jewish ritual observance and devotion no less than *b'rit milah* can. First, because ritual circumcision is often passed over in favor of hospital circumcision, and many Jews and non-Jews are not familiar with the differences, it will be helpful to explain the elements of ritual circumcision.

B'rit milah traditionally consists of three stages: *milah* (cutting), *p'riah* (peeling and removal of the inner foreskin), and *metzitzah* (sucking, either by mouth or a sterile instrument). Several blessings are traditionally recited throughout the ceremony, some of which mention circumcision. The cutting is performed on the eighth day of the baby's life (unless medical reasons necessitate a delay) by a *mohel/mohelet* (m./f.; pl. *mohalim/ot*), who is not necessarily a rabbi or a physician. (Most practicing non-Orthodox *mohalim* are physicians; the largest Jewish movements stopped training non-physicians a few decades ago. Non-Orthodox *mohalim* generally use at least some anesthetic for the procedure.) At the beginning, a friend or family member lights a candle. The baby is then brought to the "throne of Elijah," a special chair set aside for the *sandak/sandakit*, a family member who will hold the baby during the cutting. A common surgical device is the Mogen clamp, which has a slit through which the foreskin is pulled. The clamp keeps the foreskin in place and protects the rest of the penis while the foreskin is removed.

Taking place in either the home or synagogue, *b'rit milah* is a religious occasion and also a social one, at which friends and family are expected to be present. After the circumcision, the baby receives his name, traditionally not known to the community beforehand. There is often some explanation of the meaning and significance of the name. A festive meal then follows.

B'rit milah, therefore, welcomes the baby into the Jewish covenant via circumcision, but there are other aspects of the ceremony which are separable from the cutting. As we shall see, *b'rit shalom* adopts many of these aspects, welcoming the baby into the covenant without cutting. It is also important to note that naming the baby, which is possible for both boys and girls, is felt to be central by many Jews today, even though it is a somewhat minor part of the traditional *b'rit milah* ceremony [7, p 219; 20].

In some cases, *b'rit milah* is seen by Jewish communal leaders as an opportunity to religiously engage unaffiliated Jews. However, this process does not obviously rely on circumcision. In any case, among all but the most traditional Jews, it is fair to say that the reasons for performing male genital alteration are made up of religious elements, medical beliefs, familial and communal motivations, a preference for a boy to look like his father, and societal pressures, all mixed in with the prevailing acceptance of newborn male circumcision as normative in American culture.

Before we discuss the development of *b'rit shalom*, we must note that *b'rit milah* is defended strongly by the three largest American Jewish denominations (Reform, Conservative, and Orthodox), representing over 60% of American Jews [2, 21–24]. Only one small denomination, Humanistic Judaism, advocates *b'rit shalom* [25]. Yet, as noted earlier, the reality is that many Jews, including some who affiliate with these denominations, already eschew the ritual of *b'rit milah*. It is a difficult question how many Jews are interested in a ceremony like *b'rit shalom*, but increased suspicion of circumcision in American culture makes it likely that many are or might be interested.

B'RIT SHALOM

B'rit shalom ("covenant of peace") can refer to any covenantal welcoming ceremony for a newborn without circumcision, though it has so far most commonly been used, instead of *b'rit milah*, for ceremonies for newborn males. (Although *b'rit shalom* is now the most common term for this sort of ceremony, other terms include: *b'rit ben* (covenant for a son), *b'rit ḥayyim* (covenant of life), and *b'rit b'li milah* (covenant without circumcision)). The structure of *b'rit shalom* ceremonies varies widely. Many are based on practices from the *b'rit milah* ceremony, which, as noted earlier, has ritual aspects separable from circumcision itself. *B'rit shalom* ceremonies tend to focus on the baby's name and entrance into the Jewish covenant. The remainder of this section will discuss the development of *b'rit shalom* ceremonies and their significance, now and for the future.

B'rit shalom developed, perhaps surprisingly, separately from mainstream Jewish feminism. Indeed, despite the many advances spurred by Jewish feminism in the 1970s and '80 s, such as baby naming ceremonies for girls and allowing women to be *mohalot* [20, 26, 27], Jewish feminists tended not to question circumcision, perhaps because they were afraid of not being taken seriously, they wanted to spend their effort elsewhere, or they did not see questioning circumcision as a logical consequence of their views [4, pp 255–256 incl. n. 45; 6, pp 215–217]. Questioning of and objection to circumcision outside mainstream Jewish feminism laid the groundwork for *b'rit shalom* to emerge. Rabbi Sherwin Wine, the founder of Humanistic Judaism, was an early voice for separating naming ceremonies from circumcision, and for having the same ceremony for boys and girls [4, pp 231–233; 28]. Several sources on Jewish circumcision objection, which were influential on the development of *b'rit shalom* ceremonies, came out in the 1990s and early 2000s [10, introduction and epilogue; 29–35]. Some historians of circumcision have been sympathetic to *b'rit shalom* over *b'rit milah* [4, p 256; 36], and others have been ambivalent toward circumcision while recognizing its flaws [5, 7]. Questioning of circumcision continues unabated [5, 187ff., esp. 194–196; 37–41].

The term *b'rit shalom*, although circulating earlier, became more prominent over the last couple decades. Two websites which played an important role were Mark Reiss's network Celebrants of Brit Shalom, which eventually came to include hundreds of Jewish clergy who, on or off the record, said they performed *b'rit shalom* ceremonies, i.e., ceremonies for Jewish infant males without circumcision; and Rebecca Wald's website Beyond the Bris [42], which has hosted many articles and blog posts, acting as a resource and forum for those who question circumcision. An important document dedicated to *b'rit shalom* is Lisa Braver Moss and Rebecca Wald's book *Celebrating Brit Shalom*, a how-to guide with instructions for several different sorts of *b'rit shalom* ceremony [43]. These ceremonies preserve some elements of the *b'rit milah* ceremony and adapt others, such as cutting a pomegranate instead of a foreskin. Braver Moss and Wald are included among the founders of the Jewish non-profit Bruchim, which advocates for active inclusion in Jewish communal life of those who do not circumcise their children and/or are not themselves circumcised.

Having outlined the history of *b'rit shalom*, we can move on to its significance. One reason *b'rit shalom* is significant is that it is an area for liturgical innovation. Without longstanding precedent for the ceremony's details, *b'rit shalom* provides opportunities for parents to craft ceremonies that are meaningful to them for welcoming their baby boys, rather than deferring to a *mohel* or eschewing a ceremony altogether. They can either rely on a guide such as Braver Moss and Wald's book [43], on a clergy member who will create and/or lead a service, or on their own preferences. This process in some ways picks up on earlier creative Jewish approaches to tradition, such as that of *The Jewish Catalog* [44, 45]. This flexibility also matches the current situation for covenantal

and naming ceremonies for newborn females [7, p 219; 20, 26]. (It is a difficult question, which is far from settled in Jewish life, whether there should be the same sort of ceremony for babies of all sexes. Those who think yes might embrace *b'rit shalom*, as do Humanistic Jews, but most Jews have so far chosen to hold different ceremonies while making them similar qua the naming of the baby.)

Another reason *b'rit shalom* is significant is that it provides ritual options for those who now object to circumcision and for those who will in the future. A variety of Jewish ritual and expression is encouraged in many parts of the Jewish world, which *b'rit shalom* adds to. Prominent Jewish voices, including Julie Pelc Adler, then-Director of the Brit Milah Program of Reform Judaism, have recommended crafting *b'rit* ceremonies which use language meaningful to Jews today [46]. Pelc Adler notes that over half the circumcisions performed by Reform *mohalim* are for families not affiliated with a synagogue. *B'rit shalom* advocates agree with Pelc Adler's interest in meaningful ceremonies but disagree that circumcision is necessary. Presumably some of those unaffiliated families, and others who have no contact with a *mohel*, would prefer a ceremony without genital cutting; *b'rit shalom* gives them that option, which can be important for an event as significant as welcoming a child into the Jewish covenant.

A third reason *b'rit shalom* is significant is that it can promote gender egalitarianism, which is increasingly a concern for many Jews [9]. Reform, Conservative, and other liberal Jewish movements have redoubled their commitments to gender equality, among other issues, as parts of American society have moved, even if superficially, toward doing so. Although circumcision has not been sufficiently recognized as a feminist issue in the past, *b'rit shalom* certainly is a feminist issue, one which prizes Jewish connection while moving beyond body marking and the enshrining of masculinity [4, p 256; 31]. *B'rit shalom* focuses on care, particularly honoring maternal care, as *b'rit milah* is sometimes thought not to do [31, p 176].

A fourth reason *b'rit shalom* is significant is that it contributes to normalizing a variety of views and practices with respect to circumcision. Circumcision has in the past been identified with Jewishness, and there is still significant stigma attached to being uncircumcised, even though many clergy and institutions have an unofficial "don't ask, don't tell" policy when it comes to circumcision (conversation between authors and Lisa Braver Moss and Rebecca Wald, August 2, 2021). Braver Moss and Wald are outspoken critics of this sort of policy. Describing their experience tabling about their book *Celebrating Brit Shalom* at Reform Judaism's 2015 Biennial gathering, they note:

> [A] few rabbis indicated to us that they were fine with families' not circumcising, but preferred a kind of "don't ask, don't tell" policy about it. While privacy about such a decision might seem decorous, "don't ask, don't tell" conveys the message that there is something to be ashamed of in the decision not to circumcise. Given that the very basis of Reform Judaism is choice, a family should never be made to feel their ritual decision is shameful or "less-than." (conversation with authors, August 2, 2021)

Views vary on this topic, of course, across the Jewish world. Most denominations are officially committed to circumcision and thus would object to this goal for *b'rit shalom*. One of the most prominent Conservative Jewish legal authorities does not see uncircumcised status as a barrier to Jewish ritual participation, except perhaps in cases of circumcision objection [22]. Exclusion from a synagogue over circumcision status remains rare, though Braver Moss and Wald know of multiple recent cases. While it is beyond the scope of this paper whether circumcision should be promoted, it suffices for our purposes that *b'rit shalom* helps create a better Jewish world for those who are not, and those in the future who will not be, circumcised.

CONCLUSION

We have given an overview of *b'rit shalom* ceremonies, i.e., Jewish newborn covenantal and naming ceremonies without circumcision. We identified salient features of *b'rit milah* which *b'rit shalom* adapts, and summarized the development of *b'rit shalom*. We then argued for the significance of *b'rit shalom* by identifying four benefits: 1) liturgical innovation, 2) increased ritual options, 3) gender egalitarianism, and 4) reducing circumcision-related stigma. This article will hopefully lay the foundation for more discussion of possible benefits and drawbacks of *b'rit shalom*. In particular, proponents of circumcision sometimes argue that a Jewish parent does their child a disservice by not circumcising him as an infant. Although this article has only addressed those who are not and will not be circumcised, proponents of *b'rit shalom* cannot avoid these difficult questions about the evolving role of circumcision in Jewish communities. If circumcision is expected in many Jewish communities, *b'rit shalom* might remain on the margins. Those debating the merits of *b'rit shalom* must therefore understand the stakes of circumcision decisions in the larger Jewish world; hopefully further research and Jewish communal discussion can shed light on this topic. Trends about the prevalence of circumcision in American society more broadly, which are difficult to predict, are also likely to impact *b'rit shalom*. Nevertheless, robust possibilities for *b'rit shalom* allow the Jewish community to be prepared for many different futures, especially in the plausible case that circumcision in America becomes less common.

DATA AVAILABILITY

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

REFERENCES

1. Nevins D. Early circumcision in a pandemic. Committee on Jewish Law and Standards, Rabbinical Assembly. 2020; YD 264.2020. https://www.rabbinicalassembly.org/sites/default/files/2020-12/Early%20Circumcision%20During%20a%20Pandemic%20final.pdf.
2. Pew Research Center. Jewish Americans in 2020. 2021. https://www.pewresearch.org/religion/2021/05/11/jewish-americans-in-2020/. Accessed 18 Jul 2022.
3. Reis E. Medicalization and the mainstreaming of circumcision in mid-twentieth-century America. Am Jew Hist 2021;105:321–342.
4. Glick LB. Marked in Your Flesh: Circumcision from Ancient Judea to Modern America. New York, Oxford University Press; 2005.
5. Kline Silverman E. From Abraham to America: a history of Jewish circumcision. Lanham MD, Rowman & Littlefield; 2006.
6. Cohen SJD. Why aren't Jewish women circumcised? Gender and covenant in Judaism. Berkeley, University of California Press, 2005.
7. Hoffman LA. Covenant of blood: circumcision and gender in rabbinic Judaism. Chicago: The University of Chicago Press; 1996.
8. Davis DS. Male and female genital alteration: a collision course with the law? Health Matrix. 2001;11:487–570.
9. Chesir-Teran I. The obligation of *berit milah* in the reform movement: from the 1840's to today [master's thesis]. Jerusalem: Hebrew Union College; 2014.
10. Wyner Mark E (ed). The covenant of circumcision: new perspectives on an ancient Jewish rite. Hanover NH, Brandeis University Press; 2003.
11. Greenwood H. Only 29% of secular Israelis view Jewish wedding as imperative. Israel Hayom. 2021. https://www.israelhayom.com/2021/11/19/only-29-of-secular-israelis-view-jewish-wedding-as-imperative/. Accessed 18 Jul 2022.
12. Owings M, Uddin S, Williams S. Trends in circumcision for male newborns in U.S. hospitals: 1979–2010. National Center for Health Statistics, Centers for Disease Control and Prevention. 2013. https://www.cdc.gov/nchs/data/hestat/circumcision_2013/circumcision_2013.pdf.
13. Morris BJ, Wamai RG, Henebeng EB, Tobian AAR, Klausner JD, Banerjee J, et al. Estimation of country-specific and global prevalence of male circumcision. Popul Health Metrics. 2016;14:1–13.

14. Earp BD. Male or female genital cutting: why 'health benefits' are morally irrelevant. J Med Ethics. 2021;47.
15. The ethics of male circumcision. J Med Ethics. 2013; 39.
16. Washofsky M. Why reform never abandoned circumcision. ReformJudaism.org. [Date unknown.] https://www.reformjudaism.org/beliefs-practices/lifecycle-rituals/birth-rituals/why-reform-never-abandoned-circumcision. Accessed 18 Jul 2022.
17. Nevins D. An activist covenant: Lekh Lekha 5781. Rabbi Danny Nevins. 2020. https://rabbinevins.com/2020/10/29/an-activist-covenant-lekh-lekha-5781/. Accessed 18 Jul 2022.
18. Smith S. Iceland's proposed ban on circumcision rattles Jews, Muslims. NBC News. 2018. https://www.nbcnews.com/news/world/iceland-s-proposed-ban-circumcision-rattles-jews-muslims-n910541. Accessed 18 Jul 2022.
19. Conley M. Proposed circumcision ban struck from San Francisco ballot. ABC News. 2011. https://abcnews.go.com/Health/san-francisco-circumcision-ban-striken/story?id=14179024. Accessed 18 Jul 2022.
20. Siegel SR. A Jewish ceremony for newborn girls: the Torah's covenant affirmed. Waltham MA, Brandeis University Press; 2014.
21. CCAR Responsa Committee. Patrilineal descent, conversion, and the rejection of circumcision. CCAR Responsa NYP no. 5769.4. 2009. https://www.ccarnet.org/responsa-topics/and-the-rejection-of-circumcision/. Accessed 18 Jul 2022.
22. Golinkin D. What is the halakhic status of an uncircumcised Jew? Responsa in a moment. 2015; 9. https://schechter.edu/what-is-the-halakhic-status-of-an-uncircumcised-jew-responsa-in-a-moment-volume-9-issue-no-3-february-2015/. Accessed 18 Jul 2022.
23. Leiter H. This is not welcome. The Times of Israel Blogs. 2021. https://blogs.timesofisrael.com/this-is-not-welcome/. Accessed 18 Jul 2022.
24. Ungar-Sargon E. Cut: slicing through the myths of circumcision. [Film.] 2007. https://www.cutthefilm.com/.
25. Kridel J. Birth. Society for Humanistic Judaism. 2021. https://shj.org/living-humanistic-judaism/life-cycle-events/birth/. Accessed 18 Jul 2022.
26. Cohen DN. Celebrating your new Jewish daughter: creating Jewish ways to welcome baby girls into the covenant. Jewish Lights, Woodstock VT; 2001.
27. Kolodny DR. Mystery of the covenant: a new ceremony of *simchat brit*. Kerem. 2007;11:1–14.
28. Wine S. Circumcision. *Humanistic Judaism*. 1988;16:4–8. https://sherwinwine.com/circumcision/.
29. Braver Moss L. A painful case. Tikkun. 1990;5:70–72.
30. Braver Moss L. Circumcision: A Jewish inquiry. Midstream. 1992;38:20–23.
31. Pollack M. Circumcision: a Jewish feminist perspective. In: Weiner K, Moon A, editors. Jewish women speak out: expanding the boundaries of psychology. Cleveland: Canopy Press; 1995. p. 171–187.
32. Goldman R. Questioning circumcision: a Jewish perspective. Boston, Vanguard; 1998.
33. Kimmel M. The kindest un-cut: feminism, Judaism, and my son's foreskin. Tikkun. 2001;16:43–48.
34. Tabory E, Erez S. Circumscribed circumcision: the motivations and identities of Israeli parents who choose not to circumcise their sons. In: Wyner Mark E, editor. The covenant of circumcision: new perspectives on an ancient Jewish rite. Hanover NH, Brandeis University Press; 2003. p. 166–176.
35. Wechterman E. A plea for inclusion. In: Wyner Mark E, editor. The covenant of circumcision: new perspectives on an ancient Jewish rite. Hanover NH, Brandeis University Press; 2003. p. 188–193.
36. Eilberg-Schwartz H. A masculine critique of a father God. Tikkun 1995;10:58–62.
37. Israel Story. Lost and found—part II. [Internet.] 2021. https://www.israelstory.org/episode/lost-and-found-part-ii/. Accessed 18 Jul 2022.
38. Judaism Unbound. Circumcision (and alternatives to it). [Internet.] 2021. https://www.judaismunbound.com/circumcision. Accessed 18 Jul 2022.
39. Greenberg Z. When Jewish parents decide not to circumcise. The New York Times. 2017. https://www.nytimes.com/2017/07/25/well/family/cutting-out-the-bris.html. Accessed 18 Jul 2022.
40. Boorstein M. A small but growing number of Jews are questioning the ancient ritual of circumcision. The Washington Post. 2013. https://www.washingtonpost.com/local/a-small-but-growing-number-of-jews-are-questioning-the-ancient-ritual-of-circumcision/2013/12/25/d24c5a4e-6403-11e3-aa81-e1dab1360323_story.html. Accessed 18 Jul 2022.
41. Bruchim. What is brit shalom. Bruchim. 2022. https://www.bruchim.online/what-is-brit-shalom/. Accessed 18 Jul 2022.
42. Beyond the Bris. 2022. https://www.beyondthebris.com/.
43. Braver Moss L, Wald R. Celebrating Brit Shalom. Notim Press, Oakland CA; 2015.
44. Oppenheimer M. DIY Judaism. Tablet Magazine. 2017. https://www.tabletmag.com/sections/news/articles/diy-judaism. Accessed 18 Jul 2022.
45. Hills P. A nontraditional 'circumcision' ceremony. Mothering Mag. 1987;44:40–41.
46. Pelc Adler J. What does 'brit' mean to liberal Jews in the 21st century?" Rav Blog: Central Conference of American Rabbis. 2019. https://ravblog.ccarnet.org/2019/04/brit-mean-liberal-jews-21st-century/. Accessed 18 Jul 2022.

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Max DuBoff is a board member of Bruchim. The other author declares no competing interests.

ADDITIONAL INFORMATION

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