pain relief therapy for this rare condition, which should be considered in cases of severe juvenile dysmenorrhea.

AUTHOR CONTRIBUTIONS

MS and MB recruited the patient, collected information, and drafted the article. VB and AS critically revised the manuscript. All authors approved the final version of the manuscript.

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

REFERENCES

1. Frontino G, Bianchi S, Ciappina N, et al. The unicornuate uterus with an occult adenomyotic rudimentary horn. *J Minim Invasive Gynecol*. 2009;16:622–625. https://doi.org/10.1016/j.jmig.2009.04.015.
2. Takeuchi H, Kitade M, Kikuchi I, et al. Diagnosis, laparoscopic management, and histopathologic findings of juvenile cystic adenomyoma: A review of nine cases. *Fertil Steril*. 2010;94:862–868. https://doi.org/10.1016/j.fertnstert.2009.05.010.
3. Dogan E, Gode F, Saatli B, et al. Juvenile cystic adenomyosis mimicking uterine malformation: A case report. *Arch Gynecol Obstet*. 2008;278:593–595. https://doi.org/10.1007/s00404-008-0618-3.

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Obstetrics

Maternity waiting homes as an intervention to increase facility delivery in rural Zambia

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Delays in reaching care has been identified as a primary cause of maternal mortality. This is often attributed to the long distances women need to travel to gain access to health facilities.[1] In a recent *Lancet* series, maternity waiting homes (MWHs) were identified as a solution to improve outcomes by bringing women living in hard-to-reach areas closer to a healthcare facility that provides emergency obstetric care.[2,3] However, one of the limitations identified is the dearth of outcomes data on the efficacy of MWHs as an intervention. The purpose of this study was to determine the potential for MWHs to increase facility-based deliveries in three rural districts in Zambia.

Using a matched cohort design in rural Zambia, six primary healthcare facilities with new MWHs (intervention group) were matched to six facilities without MWHs (comparison group). The sites were matched for population demographics, size, and location. Ethical

approvals were obtained from the University of Michigan Institutional Review Board (IRB), Boston University IRB, and the ERES Converge Research IRB, a private local ethics board in Zambia. The monthly data collected from facility registries included number of facility and home deliveries. The percentage of deliveries taking place in a facility each month was calculated as the number of facility-based deliveries divided by the total number of deliveries taking place in each catchment community (Equation 1). The number of transfers from the healthcare facility to a referral hospital was reported monthly.

$$\text{Percent Facility Delivery} = \frac{\text{Facility Deliveries}}{\text{Facility Deliveries} + \text{Home Deliveries}} \times 100$$

Over the duration of one year (November 2016– October 2017), mean facility deliveries per facility per month were 20.4 (SD=3.86) for the MWH intervention group and 19.33 (SD=3.79) for the comparison group. Additionally, mean Home Deliveries per facility catchment area per month were 0.38 (SD=0.26) for the MWH intervention group and 1.89 (SD=0.80) for the comparison group. This resulted in a 7.57 percent increase (P=0.002) in the proportion of deliveries occurring in a healthcare facility for the MWH intervention group versus comparison facilities. Additionally, there were 182 referrals from healthcare facilities with a MWH compared to 127 for healthcare facilities without a MWH. However, the difference was not statistically significant (P=0.421). Mean monthly referrals per facility were 2.52 (SD=1.04) and 1.76 (SD=0.72) for intervention and comparison groups respectively.

This is the first study to indicate that MWHs improve the rate of facility deliveries. Maternity waiting homes are one strategy to increase facility delivery for women living the greatest distance from a healthcare facility[4] Additionally, pregnant women require close monitoring and attention from the healthcare staff while they stay at the MWH, allowing for prompt referrals when complications occur. As the quality of both the MWH structures and the care received at the healthcare facility improves, MWHs have the potential to serve a greater number of women and contribute to the improvement of maternal and newborn outcomes in rural Zambia. These results provide rationale for further investigation into the potential for MWHs to improve maternal health outcomes.

AUTHOR CONTRIBUTIONS

JRL and JEP conceived the study; JEP, GKM, AN, NL, JRL, and MLM carried out data collection, and analysis and interpretation of the data. JEP drafted the manuscript; JEP, GKM, AN, NL, JRL, and MLM critically revised the manuscript for intellectual content. All authors read and approved the final manuscript.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest.

REFERENCES

1. Geleto A, Chojenta C, Musa A, Loxton D. Barriers to access and utilization of emergency obstetric care at health facilities in sub-Saharan Africa: A systematic review of literature. *Syst Rev*. 2018;7:183.
2. Campbell OM, Calvert C, Testa A, et al. The scale, scope, coverage, and capability of childbirth care. *Lancet*. 2016;388:2193–2208.
3. Lori JR, Munro-Kramer ML, Mdluli EA, Musonda GK, Boyd CJ. Developing a community drive sustainable model of maternity waiting homes for rural Zambia. *Midwifery*. 2016;41:89–95.
4. Dadi TL, Bekele BB, Kasaye HK, Nigussie T. Role of maternity waiting homes in the reduction of maternal death and stillbirth in developing countries and its contribution for maternal death reduction in Ethiopia: A systematic review and meta-analysis. *BMC Health Serv Res*. 2018;18:748.