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EDITED BY

Elsie L. Olan,
University of Central Florida, United States

REVIEWED BY

Gül Kadan,
Cankiri Karatekin University, Türkiye
Zay Yar Swe,
Burnet Institute, Australia

*CORRESPONDENCE

Marni Sommer
✉ marni.sommer@columbia.edu

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Piloting puberty content books and a teacher training guide in Sierra Leone: a qualitative assessment

Susi Martinez¹, Sylvia Ohene Marfo², Aisha Fofana Ibrahim³,
Allison Carney⁴, Frances Vavrus⁵, Mohamed Kabba⁶,
Natalie Wyss¹ and Marni Sommer^{1*}

¹Department of Sociomedical Sciences, Mailman School of Public Health, Columbia University, New York, NY, United States, ²Union for African Population Studies, University of Ghana, Accra, Ghana, ³Institute for Gender Research and Documentation, Fourah Bay College, University of Sierra Leone, Freetown, Sierra Leone, ⁴Independent Consultant, New York, NY, United States, ⁵International Division, University of Wisconsin, Madison, WI, United States, ⁶Independent Education Consultant, Freetown, Sierra Leone

Introduction: Ensuring young people receive adequate information and guidance about puberty is essential for healthy adolescent transitions. Although many countries are moving toward including comprehensive sexuality education in national curricula, content on puberty during early adolescence, including peer pressure and stigma related to physical and emotional changes, are rarely included. Limited evidence exists about the inclusion of puberty education in schools, and the role of teachers in delivering such content in low- and middle-income countries, including Sierra Leone.

Methods: We conducted a qualitative assessment using multiple methodologies (in-depth interviews with teachers; focus group discussions with girls and boys; key informant interviews with teacher training lecturers and government) to explore the feasibility and acceptability of a puberty education package (a teacher training guide and boys' and girls' puberty books) for primary school teachers to introduce puberty content in Sierra Leone.

Results: Three key themes were identified, including the importance of teacher comfort in discussing puberty, the value of the teacher's guide for delivering puberty content, and system and resource constraints that impact the implementation of puberty education. Additional insights included how integrating puberty education into existing curriculum courses may be more effective than stand-alone puberty classes; education systems can enable in-service and pre-service teacher training, along with culturally appropriate puberty resources, to increase effective puberty education delivery in schools; and governments serve a key role in providing puberty education teacher training, ensuring sustainable funding to retain trained teachers, and offering guidance on national curriculum requirements on puberty education.

Discussion: There is a strong need to integrate puberty education into formal educational systems, with well trained teachers serving a valuable role in its delivery. Research is needed on how best to scale sustainable teacher training interventions to support the delivery of puberty education to adolescents in low- and middle-income contexts.

KEYWORDS

teachers, teacher training, adolescents, puberty, menstruation, puberty education, Sierra Leone, sub-Saharan Africa

Introduction

The transition into puberty is marked by rapid mental, emotional and physical growth and significant social changes (Viner et al., 2017). The latter introduces new peer pressures and shifts in gendered expectations within the family and larger society for which a young person may not be prepared (Kågesten et al., 2016). Research from Europe, North America, Africa, and Asia, has demonstrated the need for more youth support mechanisms during very early adolescence, including the transition through puberty (Sommer et al., 2015; Kågesten et al., 2016; Chandra-Mouli et al., 2017; Mmari et al., 2017). Ensuring young people receive adequate information and guidance is essential healthy transitions into and through adolescence. This is particularly the case in Sierra Leone, where this qualitative study that assessed a new puberty education delivery approach for teachers in schools, given the limited existing curriculum.

Global guidance stresses the importance of puberty education, ranging from its inclusion in life skills education to science lessons (UNESCO, 2018). School-based efforts often focus on biological elements of the pubertal transition (e.g., physical growth, hormonal changes) rather than the social or emotional aspects; and, early adolescent pubertal content may also be under-addressed in favor of sexual health topics, such as contraceptive use and safe sex (UNESCO, 2018; Crockett et al., 2019). Though important, the latter are commonly delivered to older adolescents (Nash et al., 2019; Zulu et al., 2019), missing the opportunity to introduce foundational learning on puberty to young adolescents (Sommer et al., 2015). Health and education systems often assume that young people will learn about puberty in the private sphere (Sommer et al., 2015). Yet evidence suggests that parents, caregivers, and families are frequently uncomfortable with the topic and share minimal information with youth (Crichton et al., 2012; Wanje et al., 2017; Mahfuz et al., 2021). This increases the need for formal puberty education distinct from the broader portfolios of sexual and reproductive health or comprehensive sexuality education (CSE).

While puberty education gaps are a concern globally, they are especially salient in low-income countries due to barriers related to education, limited resources, and cultural concerns (Coast et al., 2019; Crockett et al., 2019; Sommer et al., 2019). In some contexts, there are growing efforts to educate girls about menstrual health and hygiene (Sommer and Sahin, 2013; Montgomery et al., 2016; Phillips-Howard et al., 2016), although educational content may not include the full-spectrum of puberty-related topics (UNESCO 2014; Crockett et al., 2019). Research in Kenya, Tanzania, and elsewhere also suggest that boys can be left out of puberty education entirely (Sommer et al., 2014; Alimohammadi et al., 2019; Carney et al., 2022). While menstrual health and puberty content is often delivered through programming supported by non-governmental organizations to youth in and out of schools, primary and secondary schools are shifting to integrate some CSE and puberty education into existing curricula, such as Home Economics and Social Studies (Keogh et al., 2018; Wekesah et al., 2019; Mahfuz et al., 2021). However, despite a 2014 UNESCO recommendation for the integration of puberty content into primary school curricula (Kettaneh et al., 2014), minimal research has explored its delivery in and through education systems (Austrian et al., 2021).

One potential approach to improving puberty content integration into national curricula and classroom learning includes building the capacity and comfort level of teachers in its delivery. Some studies

suggest that the quality and depth of teacher knowledge and practice, in mathematics and literature for example, can impact student learning (Bashir et al., 2018). These insights may be useful with regard to sensitive health topics such as puberty. While minimal research exists on teacher practice delivering puberty education globally, some literature from sub-Saharan Africa documents how teachers' lack of knowledge on and discomfort with puberty and menstruation perpetuates the delivery of inaccurate, little, or no information on these topics (Sommer and Sahin, 2013; de Haas and Hutter, 2019). Teachers are often hesitant to discuss puberty and menstruation (Wanje et al., 2017), and corporal punishment can hinder trust between students and teachers on sensitive topics (Le Mat et al., 2019). Sierra Leone is no exception, with little documented about young people's puberty experiences or about how teachers discuss puberty in the classroom.

Sierra Leone experiences multiple education gaps, including puberty content, low literacy, limited teacher workforce, a lack of school resources (Statistics Sierra Leone, 2017a; World Bank, 2021), and puberty content. The literacy rate among 15–25 year olds is 64% for females and 72% for males; only 16% of children in grades 2 and 3 meet the expected level of literacy for their grade; and 97% of children in the poorest wealth quintile do not meet foundational literacy and numeracy skills (Statistics Sierra Leone, 2017b). Potentially due to these constraints, Sierra Leone has not included broader puberty health education in its curricula (Government of Sierra Leone, 2022). Importantly, the government adopted the National Policy on Radical Inclusion in 2020, which includes objectives to develop a CSE curriculum (Ministry of Basic and Senior Secondary Education, 2021). Sierra Leone is thus poised to adopt and incorporate puberty education into its national curriculum, making it important to understand how it can best be integrated into classrooms.

Since 2019, the Transforming Girls Education Project (TGEP) – led by The Association of Language and Literacy Educators-Reading Sierra Leone (TALLE-RSL) and CODE (Canadian non-governmental organization) – has worked with teachers to bolster skills related to gender responsive pedagogy and sexual health and rights and provide teachers and students with literacy materials on these subjects. In 2019, TALLE-RSL and CODE partnered with the non-governmental organization Grow & Know to develop puberty books for girls and boys in Sierra Leone. They subsequently developed a complementary three-step lesson plan teacher training guide with Columbia University. In 2022, the puberty books and teacher guide were distributed to 260 primary schools for use in Class 6 lessons and in boys' and girls' clubs. The aim of this study was to explore the appropriateness and usefulness of the puberty books and teacher training guide for Class 6. Additionally, the study aimed to identify potential sociocultural, economic, and political barriers to, and opportunities for, widespread uptake of puberty content in schools and the broader education system.

Methods

Research setting

The study was conducted in three districts of rural and urban Sierra Leone in November 2022: the Western Area Rural/Urban District, Bo District (Southern Province), and Port Loko District

(Northern Province). As of 2015, Western Area Rural had a primary school net enrollment ratio (NER) of 73%, and the Western Area Urban, which is considered the urban, economic, financial and political center of the country, had a 77.1% NER (OCHA Sierra Leone, 2015b; Statistics Sierra Leone, 2017a). Bo District is the second most populous district in the country and had a 69.25% primary school NER in 2015 (OCHA Sierra Leone, 2015a; Statistics Sierra Leone, 2017a). Port Loko District had a 64.2% primary school NER (Statistics Sierra Leone, 2017a). Overall in Sierra Leone, 2 out of 10 students are unlikely to complete primary school, with 7 out of 10 unlikely to complete senior secondary school (World Bank, 2021).

Research design

A formative qualitative assessment of the feasibility and acceptability of the teacher training guide and puberty books was conducted in November 2022 using multiple qualitative methodologies: (1) In-depth Interviews with in-service teachers, boys' and girls' club leaders, and school administrators (e.g., Head Teachers); (2) Focus group discussions with male and female students ages 10 to 14; and (3) Key informant interviews with education and government stakeholders, including faculty at Teacher Training Institutes (TTIs). The study team developed three semi-structured interview guides, which were iteratively revised with local education stakeholders.

In-depth interviews

Explored teacher comfort with delivering puberty education, challenges faced when using the puberty books, impressions of the teacher training guide, and how sociocultural norms impact puberty book use and/or puberty education in general.

Focus group discussions

Examined students' impressions of the books, the sociocultural and linguistic challenges of using the books, experiences with learning puberty content in the classroom or club (including the delivery approach), gendered dynamics during lessons, teacher engagement, and recommendations for using the books with other students.

Key informant interviews

Probed potential barriers to the delivery of puberty education in school settings, opportunities for in-service or pre-service teacher training, how social and cultural environments may impact the delivery of this content, and potential policy implications.

Institutional Review Board (IRB) approval was acquired from Columbia University Medical Center (CUIMIC) IRB in New York City, and the University of Sierra Leone IRB in Freetown.

Sample and recruitment

Study participants (see Table 1) were purposively sampled from schools participating in TGEP that received the puberty books and teacher training guide. The selection included one urban school and one rural school in Districts 1 and 2. Two urban schools (and no rural schools) were selected in District 3. Student participants (ages 10–14) were recruited if they had received puberty lessons in a Class 6 or a boys' and girls' club setting and differed in academic abilities and

TABLE 1 Summary of study sample.

Method	Participants	Location
In-depth interviews	<p>$n = 13$</p> <ul style="list-style-type: none"> Class 6 teachers (1 female, 1 male) Boys and girls club leaders (2 female, 2 male) Head teachers (4 female, 2 male) 	<p>6 schools in 3 districts</p> <p>District 1 Schools: 1 urban, 1 rural</p> <p>District 2 Schools: 2 urban, 1 rural</p> <p>District 3 Schools: 3 urban schools</p>
Focus group discussions	<p>$n = 118$ (12 focus groups; $n = 6-10$ students/group)</p> <ul style="list-style-type: none"> Ages 10–14 6 groups, class 6 6 groups, boys, and girls clubs 	
Key informant interviews	<p>$n = 12$ (6 female, 6 male)</p> <ul style="list-style-type: none"> Education, health, and government stakeholders Teacher training institutes 	<p>District 1 and 2: TTIs</p> <p>District 3: Govt and NGOs</p>

religious and socioeconomic backgrounds. In-depth interview participants were sampled from the school administration and faculty, including Class 6 teachers, boys' and girls' club leaders, and Head Teachers who had received the TGEP training. Key informants were sampled to capture a diversity of perspectives and included government and education stakeholders (e.g., Ministry of Education, Ministry of Health, TALLE-RSL, and faculty and administrators at TTIs).

Data collection

The data collection team included a senior female qualitative researcher from the region, a local male research assistant, and two female research data collection assistants from (*blinded*). Prior to data collection, the team conducted reflexivity exercises, considering their positionality in relation to the power dynamics of the research process and the dynamics of engaging with adolescents. All interviews and focus groups were conducted in private settings (e.g., office or classroom with the door closed). Interviews were 45–60 min, audio-recorded and transcribed for analysis. All interviews were conducted in English, with one rural focus group conducted in Krio/Temne with a local translator. Given noisy conditions, the research team took copious notes in addition to the audio-recording to construct transcripts. Parents were informed about the study, which had a waiver of parental consent, and all of the adolescents provided assent (focus groups), while informed consent was obtained from all IDI and KII participants.

Data analysis

The data were analyzed using inductive thematic analysis (Charmaz, 2006). Two members of the research team read all interview transcripts and identified a preliminary list of codes. Codes were cross checked for consistency and discrepancies, revised to

minimize the overlap of codes, and organized based on thematic categories (Saldaña, 2013). The resulting primary codebook was then discussed, evaluated, and reconfigured by the entire study team. Once achieving agreement to finalize the primary codebook, two independent coders applied the codes to all interviews in Dedoose 9.0.83 (SocioCultural Research Consultants, LLC, 2021). Analytic memos based on the dataset were also recorded for reference during analysis phases (Liamputtong, 2009; Saldaña, 2013).

Results

The analysis identified three key thematic areas: (1) the importance of teacher comfort in discussing puberty, (2) the value of teachers' guides for puberty content, and (3) system and resource constraints for implementing puberty education.

The importance of teacher comfort in discussing puberty

Across urban and rural sites, teachers (both Class 6 and those serving as club leaders) who received the teacher training guide and puberty books shared their initial discomfort with teaching puberty content to their students. Explanations included a lack of experience talking about puberty with youth and an absence of (or limited) in-service or pre-service training on puberty topics prior to receiving the teacher guide and books. Existing pre-service training, teachers explained, may cover puberty within the context of biology, but it the range of physical, emotional, and social changes experienced by youth, or how to deliver such content.

Urban and rural teachers described how the TGEP in-service training bolstered teacher comfort and confidence with delivering puberty education, facilitated by the teacher training guide and puberty books. A female Class 6 teacher at an urban school highlighted the benefits of this training, speaking to the importance of building teacher knowledge:

[Without the training], I would have felt uncomfortable, and I [would] not know that much to explain in-depth about these things. I [would] have done the explanation, but not very well.

The above quote emphasizes the importance of reducing teacher's discomfort and strengthening their ability to deliver accurate and more thorough puberty information. Several teachers also shared that as youth they had been left to learn about puberty on their own. Hence, the in-service training and teacher training guide served to, as one female urban Class 6 teacher indicated, "give us the courage that these are things that we should tell the children."

Sociocultural influences also affected teachers' hesitation toward discussing puberty topics and their comfort levels in both rural and urban schools. As one rural male Class 6 teacher explained, "...we were not taught [puberty]... You know in fact... such things are classed as taboo within certain societies." Teachers and TTI lecturers described a societal perception that young people should not be taught puberty topics, particularly in early adolescence. As one TTI lecturer explained, "...in our society to call [mention] female reproductive

organs is a crime. To say 'vagina' in a home is a crime." These beliefs were evident in the experiences of some teachers when delivering the puberty education, particularly in the rural areas. As one female teacher described:

...Even [when] we look at [the books] some of us [teachers] are ashamed because there are pictures of erections... [But] I am the teacher to teach them, so if I am not comfortable, can the children be comfortable? So I think I started understanding it that way, that I should be comfortable first. That way it should be easy to interact with the children.

Most teachers who received the training and used the guide and puberty books described a shift from discomfort to embracing their role as puberty educators. Teachers explained that the training helped motivate them by increasing their comfort around puberty topics. As one male class 6 teacher explained:

And more especially the "Growth and Changes" [books] for the puberty period and the way the university facilitators explained it was easy and made it normal, and we can help the children to understand it.

In addition, while many teachers initially perceived teaching puberty as an additional burden on their workload, several described how the TGEP training shifted their perception. They reported gaining insight on the value of puberty education and realizing that integrating puberty lessons into existing classes did not greatly impact their workload.

Teacher comfort with delivering puberty education was also influenced by gender dynamics within the classroom. Teacher shortages across Sierra Leone, especially in rural areas, often results in only a male or a female teacher charged with introducing the puberty books to both girls and boys. There are also more male than female teachers across the country. Most of the Class 6 and boys' and girls' club teachers interviewed were male, several of whom expressed less confidence educating girls about menstruation because it is socially taboo. Despite this discomfort, all teachers noted that the guide prepared them methodologically for teaching about puberty. And although many participants highlighted the limited pre-service and in-service teacher curriculum on puberty topics, those who received the TGEP training, the teacher guide, and the puberty books described gaining increased confidence with delivering puberty lessons. They also found ways to share their newfound puberty education knowledge, with teachers who attended the training informally training other teachers, such as during weekly teacher meetings (e.g., Teacher Learning Circle).

Lastly, some teachers expressed concerns around conveying puberty content in schools. Some teachers described having asked for security training during the TGEP training to protect themselves in case parents were upset that their children were learning about puberty topics. The value of sensitization around the importance of puberty education was reinforced by the TTI lecturers and government officials. Many key informants articulated how an important first step to introducing puberty education across the country is to facilitate discussions between schools and parent/caregiver groups. As one lecturer explained:

The sensitization should precede the [puberty]...teaching. Because when people are well informed, they are well educated about this education and [its] importance. Then if the teachers start to use them now, there will not be much challenge.

While sensitization efforts with caregivers may increase teacher comfort with puberty content delivery, such an approach may increase school administrators' workload, with implications for scale-up of puberty education initiatives.

The value of teachers' guides for puberty content

The second key theme highlighted Although not always followed consistently, teachers across the rural and urban schools described how the teacher training guide shaped the ways in which teachers across the rural and urban schools introduced puberty content with students. This included content delivery aspects of the guide (e.g., lesson plan templates and active learning methods), along with guidance to use the puberty books as supplementary readers to expand upon content learned in subject areas of relevance.

Teachers in Class 6 and boys' and girls' clubs reported an overall positive experience using the teacher guide and puberty books. One club leader explained that the guide and puberty books, "helped to break the silence [between] the pupils and the teachers." Most teachers highlighted the utility of the structured lesson plan in the guide, noting that the three-step organization (pre-reading, during reading, and post-reading) increased the ease of delivery. Teachers also found this design preferable to the six-step approach suggested by Sierra Leone TTIs and the Ministry of Education, as it simplified and expedited lesson planning. As one club leader explained, it "clearly lays out the subject, the topic, [and] what the outcome should be, so you teach what is there. It is all there for you."

Teachers also appreciated the guidance to incorporate puberty content into existing relevant classes, ranging from home economics to biology, through short activities (e.g., quiet reading time). Several teachers suggested that this approach strengthens or supplements these courses with in-depth information that is lacking. As one boys' and girls' club leader at an urban school explained:

I taught them [the puberty lessons] during physical health education lessons... It [already] includes lessons about puberty and adolescence, but it does not include much information.

A number of key informants substantiated this view, including a Ministry of Education official who noted, "you cannot talk about social studies without talking about puberty." Teachers discussed how the guide addressed structural barriers to incorporating puberty education into existing curricula, such as the challenge of delivering puberty education as a standalone subject due to time constraints in the existing mandated syllabus. As one Head Teacher at a rural school explained, "puberty is not a subject on its own, and time is not allocated to it. But if we can incorporate it into another subject, we can combat the challenge."

While the teacher training guide provided lesson plan templates and suggested activities, teachers exercised discretion in its implementation. This flexibility meant that some teachers did not

use the lesson plan templates or used traditional lecture-based and group reading techniques. These variations in implementation sometimes negatively impacted the student experience. For example, the guide recommended separating girls and boys to different sides of the classroom for quiet reading time and pair discussion in same-gender dyads. This was intended to create a sense of comfort and privacy and facilitate easy discussion. However, several teachers had students read aloud in front of the class, possibly due to prior pedagogical training. Multiple students described how this led to embarrassment and discomfort. Some students were also asked to point at their body parts in mixed-gendered classes to illustrate puberty lesson content, which caused greater embarrassment.

A gap in the teacher guide emerged in relation to how to manage gendered dynamics when delivering puberty content, both student peer dynamics and those between teachers and students. In instances when there was separation of girls and boys within the room, some students still reported feeling uncomfortable when puberty education was provided, even if sitting and reading separately. This was primarily when teachers were not present during quiet reading time. As one urban female student described, "When [the teacher] is not here, [boys] take the [girl's] books and read it, and then they started laughing at us." Increased teasing occurred particularly when discussing body processes (e.g., menstruation, erections) and viewing illustrations of the opposite gender's anatomy. Nevertheless, one urban Class 6 teacher observed new ways the students began interacting around puberty topics in these shared spaces:

Sometimes the boys will ask the girls questions pertaining to their books. And then the girls will also ask the boys for them to know more pertaining to their books. It was actually the first time for them to interact with each other in that way.

This suggests that some students are comfortable and interested in learning about how the pubertal transition occurs beyond their own sex or gender. However, in both rural and urban schools, student expressed a preference to learn about puberty from same-gendered teachers, particularly the girls. This was suggested to be challenging given resource constraints across Sierra Leone that limit teacher availability.

The teacher guide also had wider implications for students' interactions with puberty education at the family and community level. About half of the teachers followed the guidance to encourage students to take the books home for extra reading time and to share their learning experience with their families. Teachers explained that this was an effective strategy to get students to read on their own, share the information, and begin conversations about puberty with family members. These books and conversations, as described by an urban boys' and girls' club leader, "tell [family members] that these things [puberty topics] are no longer a taboo. These are things that children should know." Youth who took the books home shared how family members generally had positive reactions, often stating the importance of learning about body changes and puberty. As was shared in a focus group discussion with youth who participated in a boy's and girl's club session on the puberty content:

When I read, and I see something that I do not know, then I ask my elder sister to help me...she says this book that they have given you is good and you will learn a lot of things about body changes.

Sometimes parents and siblings wanted to read the books to learn more about puberty themselves. This finding is particularly important given a concern shared early in the project that family sociocultural beliefs might hinder delivery of the puberty content. Of note, teachers in urban schools were more likely to allow students to take the puberty books home, possibly due to puberty topics viewed with less shame in urban areas. Teachers who did not allow students to take books home were primarily concerned about the books getting damaged.

System and resource constraints for implementing puberty education

A third key theme from data highlighted a shortage of educational resources as a primary challenge to the sustainability and scaling of puberty education nationally. Policy leaders and teachers described two major issues contributing to this shortage: limited learning resource materials in schools and an insufficient teacher workforce.

A shortage of puberty books for conducting puberty lessons was a common. Each of the 260 schools in the TGEP program received 50 girls' books and 50 boys' books. However, given large class sizes (some up to 74 students per class), Class 6 teachers were not always able to implement the lesson plan as intended, including allowing students to take books home. Some Class 6 teachers used a rotational system to allow 10 to 20 students to check-out the puberty books, an approach recommended in the teacher guide. In contrast, boys' and girls' club leaders, who only had 20 to 30 students, had enough books for all students take books home. Students in clubs could also more easily have individual reading time compared to those who received the book in classroom lessons. In some schools, large class sizes required students to share books (e.g., one book per 2–3 students sitting together at a desk). As school enrollment sizes and access to physical resources vary by location, it is important, as a former Ministry of Health official noted, to *"identify schools that need extra support to be able to bring them at par with other schools."* The same official emphasized the critical importance of the teacher training guide and books to delivery of a sensitive topic.

Inadequate numbers of materials hindered wider uptake and usage among teachers. Teachers who attended the TGEP training and received their own copy of the guide described taking it home to prepare for lessons. As one Class 6 teacher at a rural school described, *"I read it every night to be more grounded."* Other teachers reported making copies of the guide to share with teachers who did not attend the training. A teacher in an urban school explained, *"Sometimes we make copies. We made it available for everyone. When you want to use it, you go to the office and sign for it. When you go to the office you can get it there."* Although storing the puberty books and teacher training guide in the schools' administrative office enabled sharing of the materials among teachers, the limited quantity of teacher training guide copies per school, along with the puberty books, impacted overall access and use.

School resource management also impacted the delivery of puberty education. Many Head Teachers stored the puberty books and teacher training guide in the school's main office to enable teachers to share them more widely with students, and increase the reach of puberty lessons beyond Class 6 and clubs.

However, students described not always being able to access the books themselves directly to read or take home. It was unclear whether this was due to school administration concerns about sharing the books with students (e.g., fear of book damage), or an inability to set up a check-out system for the books. Although teachers utilized the puberty books in Class 6 and same-aged youth in the clubs, the majority of teachers recommended introducing the books in Classes 4–6 given the age at which young people begin to experience pubertal changes.

Teacher workforce constraints were another major challenge voiced by Ministry of Health officials, TTI lecturers, and teachers. These ranged from insufficient numbers of teachers, inadequate resources to pay teachers, and limited training of teachers to feel comfortable with puberty content. Respondents also described the difficulty of retaining trained teachers, especially in rural schools, which frequently have higher teacher turnover rates. Education and policy leaders also described how the teacher workforce sustainability issues leads to the dependency on volunteer teachers. In response to high teacher turnover, schools often rely on volunteer teachers who range from being fully qualified to receiving minimal or no formal teacher training at TTIs. As one former Ministry of Health official explained: *"when teachers move to other jobs, we need to get teachers. And sometimes you get teachers that are just completing training colleges or are community teachers who want to offer themselves to just help the schools."*

Policy makers, teacher training lecturers, and primary school teachers alike suggested that requirements of a new curriculum could shape national uptake of puberty education, particularly if it recommends the integration of puberty lessons into existing subjects. Many teachers across the schools suggested that this would reduce the burden of creating a new subject to fit into an already crowded daily class schedule and syllabus requirements. As one TTI lecturer explained, finding *"time to be included in their [teachers'] working timetable [would] be a difficult barrier."* TTI lecturers also suggested that integrating puberty content into existing subjects would reduce the academic burden on students.

Lecturers at TTIs stressed that introducing puberty as a standalone subject might also result in pushback from students and parents, which could result in more limited engagement with the content. As puberty content is not currently included in the national education exams, one lecturer expressed concern that teachers and students *"might not take it seriously...[and] the parents will say it is an additional academic burden on the children [to add it]."* A Ministry of Education official also shared reservations about making puberty a separate examinable subject, given that it would encourage rote memorization of the materials to *"just be read and passed and then after that forgotten,"* rather than having students meaningfully absorb and apply lessons in their lives. Although not a universal perception, some key informants in the TTIs and education government sector indicated that given the influence of national exams on how teachers, students, and caregivers interact with education in schools, puberty lessons may be more effective for students if they remain out of national exams.

Despite these system and resource constraints, education officials conveyed an overall positive message around the important role of teachers for the delivery of puberty-related content. One TTI lecturer succinctly explained that schools can *"use [teachers] as change agents"* for promoting learning around puberty education.

Discussion

This formative qualitative assessment of the delivery of a teacher training guide and puberty books in Sierra Leone yielded important insights into how puberty education can be implemented at greater scale. Our findings highlighted the importance of having adequate training and support mechanisms for teachers and students, working with caregivers and community members to reduce societal concerns about providing puberty education, and addressing educational system issues, including material resources and teacher workforce issues. Overall, incorporating puberty reading and discussion into existing curriculum, rather than as a new standalone subject, was determined to be the most viable approach for enacting national puberty education. Importantly, despite the expectation that teachers would struggle to feel comfortable teaching puberty topics, the teachers greatly welcomed opportunities to build their capacity and confidence in delivering puberty education. Families, in large part, similarly appreciated the sharing of puberty books and supported puberty education in schools, contrary to anticipated resistance from caregivers prior to this study.

Educational resources (puberty books and teacher training guide) were found to be necessary but not always sufficient to help students and teachers feel more comfortable and navigate the challenges that come from discussing a taboo subject, such as puberty. Most participants noted that sociocultural norms make puberty a difficult or uncomfortable topic to incorporate into the classroom or club setting. As in other countries, cultural norms around puberty shape how puberty lessons are taught and received (Mkumbo, 2012; Acharya et al., 2019; Joseph et al., 2021; Mahfuz et al., 2021). This was exemplified in a quantitative study conducted in the Kinondoni and Sengerema districts of Tanzania, in which teachers ($n = 96$ rural; $n = 102$ urban) completed a questionnaire on their views and attitudes toward school-based sexuality education; rural teachers reported being less confident than urban teachers in conveying sexuality content due to strong social taboos in the community (Mkumbo, 2012). Rural teachers in Sierra Leone similarly expressed more hesitancy toward puberty lessons than their urban colleagues. However, as seen in Bangladesh and Ghana (Oduro and Miedema, 2019; Mahfuz et al., 2021), the Sierra Leonean teachers affirmed that puberty education resources (e.g., trainings, training guides, and puberty books) strengthened their comfort and confidence to deliver puberty lessons; these resources also enabled them to foster environments where students were comfortable engaging in puberty education despite sociocultural taboos. Although large class sizes and limited resources often limit the use of participatory and individualized teaching methods in sub-Saharan Africa (Wangamati, 2020), individualized reading and learning opportunities within supportive school environments is important, especially given the sensitivity of puberty content.

The gendered aspect of teacher and student learning in the classroom also surfaced as relevant for consideration in shaping conducive learning environments for puberty education. Girls, in particular, voiced interest in receiving puberty lessons from young, female teachers whom they perceived as having recently experienced similar body changes. These preferences have been documented in Ghana, Ethiopia, and Malawi, where girls articulated feeling more comfortable learning about puberty and sexual and reproductive health from female teachers (Blake et al., 2018; Nash et al., 2019; Oduro and Miedema, 2019). A study from Ethiopia found that having majority male teachers deliver puberty and menstrual health education limited female students' comfort discussing

these topics in the classroom (Blake et al., 2018). In our Sierra Leone study, male teachers reported some discomfort around teaching topics like menstruation to female students despite receiving training and guidance from the puberty materials. Most of the teachers in this study were male, reflecting the 70% of the male teacher workforce in Sierra Leone (World Bank, 2021). The discomfort felt by male teachers and female students alike, underscores a need to create gender-sensitive spaces to teach and learn about puberty. Some schools in our study strove to create gender-sensitive spaces by having both male and female teachers present in the classroom to deliver puberty lessons for boys and girls.

Community and caregiver acceptance were also identified as important factors for the viability of puberty education. In Sierra Leone, school efforts to gain parental and caregiver support was an important first step to delivering puberty education. Community sensitization strategies to implement CSE and sexual and reproductive health education in schools across sub-Saharan Africa have similarly found that increasing awareness, acceptance, and support among caregivers and community leaders in advance of providing education is essential (Nash et al., 2019; Oduro and Miedema, 2019; Adebayo et al., 2022; Agu et al., 2022). However, it is important to note that in many contexts, the conflation of puberty education with CSE also impacts school, teacher, and community support. For instance, a study in South Africa found that many parents and caregivers believed that teachers were encouraging their children to partake in sexual behaviors if puberty-related topics are taught in the classroom (Mavhandu et al., 2022), an added challenge that teachers and schools must navigate.

Education system limitations at national and local levels also have a major impact on the potential delivery of puberty education in Sierra Leone. Teacher workforce shortages and a lack of pre- and in-service puberty education training were suggested to serve as barriers to the effective delivery and sustainability of such an effort. Despite these challenges, the study's findings indicated that the provision of consistent and quality guidance on implementing puberty education increases teachers' confidence and could help to ensure the sustainability of lessons delivered in schools. As evidenced in this study, and reflected in findings conducted in the Netherlands, the United Kingdom, and Brazil (Arnab et al., 2013; van Lieshout et al., 2017; Briñez et al., 2019), teacher training resources that include a mix of interactive and individual teaching methods (e.g., small group discussions, question and answer activities, and silent reading time), are effective tools in delivering puberty education. The teaching resources (e.g., activities and lesson plans) outlined in the Sierra Leone teacher guide, complemented with the country-specific puberty books, supported teacher preparedness to deliver puberty education. Similarly, teachers receiving training in CSE, such as in Zambia, have been found to be better prepared and create supportive environments to effectively deliver content in schools (Wekesah et al., 2019).

Teachers' interest in more expansive training on puberty education at the pre- and in-service levels in our study also points to gaps in current support mechanisms for teachers. Pre-service teacher training in particular can create a more sustainable approach to comprehensive puberty and menstruation education, as was found in Bangladesh (Mahfuz et al., 2021). Given that the pre-service educational system does not reach a large portion of volunteer (and hired) teachers in Sierra Leone, it is important to also offer in-service training opportunities on puberty education. This is particularly important in rural areas, as teachers had less formal training and lower

rates of retention. As seen in a review of 10 years' of implementing a CSE program in Uganda, Kenya, Thailand and Indonesia, high staff turnover and the lack of follow-up training impact the sustainability of providing such education (Vanwesenbeeck et al., 2016). These systemic and policy gaps in Sierra Leone highlight a need to prioritize addressing systemic challenges, including strengthening a sustainable teacher workforce trained in puberty education.

Finally, teachers and schools may need support in navigating the implementation of national policies related to puberty when national curriculum requirements shift. For example, in Australia, a 2015 policy requiring teachers to implement a new Australian Curriculum for Health and Physical Education, which included sexuality and puberty education, lacked clear guidance on how standards should be implemented and to what extent states, territories, schools and teachers could adapt the guidelines. This resulted in confusion among schools and teachers on how much agency and authority they had in delivering sexuality and puberty education (Ezer et al., 2018). Although Sierra Leone's Ministry of Education is incorporating puberty and CSE into the national curriculum, it is unclear whether puberty topics will part of required national exams for primary school students. In an analysis of challenges to implementing CSE curricula in Peru, Ghana, Kenya, and Guatemala, making puberty and CSE topics examinable was found to motivate administrators, teachers, and caregivers to prioritize these subjects (Keogh et al., 2018). However, this study suggests this may not always be the case in Sierra Leone. Some policy makers, lecturers, teachers, and caregivers expressed not wanting puberty education to be examinable, as it would increase the academic burden on students and create more of a workload for already overstretched and in some cases unpaid teachers.

Limitations

There are two limitations to note. One, due to funding and COVID-related delays, the timeline for the delivery of the educational approach assessed by this study occurred over a shorter time frame than intended. The puberty books and teacher training guides were provided to schools and assessed 6–8 weeks later. This limited teachers' opportunity to make full use of the teaching guide and puberty books in their classrooms and clubs, and thus impacted the degree to which students could engage with puberty education materials. Two, the small budget for this project limited the ability to explore learning with the guide and books in additional areas of the country, which would have served to expand upon insights about enablers and barriers to the delivery of puberty education in a greater diversity of the country.

Conclusion

This qualitative assessment in Sierra Leone provides critical learning about the potential for teacher engagement in puberty education among youth aged 10 to 14 years old. Three key recommendations emerged: One, the integration of puberty education within mandated curriculum courses may be more effective than having stand-alone puberty education classes; Two, education systems can enable the delivery of puberty education by providing in-service and/or pre-service teacher training, along with culturally appropriate puberty resources (e.g., locally tailored teacher training guide and

puberty books/materials); Three, governments serve a key role in providing teacher training on puberty content, ensuring sustainable funding to retain trained teachers, and offering clear guidance on national curriculum requirements on puberty education. While a small undertaking overall, the Sierra Leone puberty education materials (teacher training guide and puberty books) and this assessment provide essential learning for the larger global agenda to improve and expand population health through the delivery of puberty education to early adolescents in resource constrained environments. Perhaps most important, both teachers and families, along with the youth, showed enthusiasm and interest for learning about puberty when teachers are adequately capacitated and resourced to deliver the content in school.

Data availability statement

The raw data supporting this study may be made available by the authors upon request, as permitted by our respective IRBs.

Ethics statement

This study involving human subjects research was approved by the CUIMC IRB and the University of Sierra Leone IRB. The IRBs waived the requirement of written informed consent for participation from the participants or the participants legal guardians/next of kin because of literacy levels and the non-invasive aspect of the study; expedited review.

Author contributions

SuM: Data curation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. SyM: Data curation, Formal analysis, Investigation, Writing – review & editing. AI: Conceptualization, Investigation, Writing – review & editing. AC: Data curation, Investigation, Writing – review & editing. FV: Conceptualization, Investigation, Supervision, Writing – review & editing. MK: Data curation, Investigation, Writing – review & editing. NW: Formal Analysis, Writing – original draft, Writing – review & editing. MS: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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