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# Climate change, resource insecurities and sexual and reproductive health among young adolescents in Kenya: a multi-method qualitative inquiry

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#### ABSTRACT

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**Correspondence to** Dr Carmen H. Logie; carmen.logie@utoronto.ca **Introduction** Growing evidence supports linkages between climate change and extreme weather events (EWEs) and sexual and reproductive health (SRH) among adults. Yet knowledge gaps persist regarding climate-related experiences and pathways to SRH among young adolescents (YA). We conducted a multi-method qualitative study to explore climate change-related factors and linkages with SRH among YA aged 10–14 years in Kenya.

**Methods** This six-site study was conducted in Nairobi's urban slum Mathare; Naivasha's flower farming community; Kisumu's fishing community; Isiolo's nomadic and pastoralist community; Kilifi's coastal smallholder farms and Kalobeyei refugee settlement. Methods involved: n=12 elder focus groups, n=60 YA walk-along interviews (WAIs) and n=12 2-day YA participatory mapping workshops (PMWs). We conducted codebook thematic analysis informed by the resource insecurity framework.

**Results** Participants (n=297) included: elders (n=119; mean age: 60.6 years, SD: 7.9; men: 48.7%, women: 51.3%), YA WAI participants (n=60; mean age: 13.4, SD: 1.5; boys: 51.4%, girls: 48.6%) and YA PMW participants (n=118; mean age: 12.1, SD: 1.3; boys: 50.8%, girls: 49.2%). Narratives identified climate-related changes and EWEs increased existing resource insecurities that, in turn, were linked directly and indirectly with SRH vulnerabilities. Food and water insecurity contributed to YA missing school, sexual violence, transactional sex and exploitative relationships. Sanitation insecurity produced challenges regarding menstrual hygiene, sexual violence risks and transactional sex. Transactional sex and exploitative relationships were linked with unplanned pregnancy and sexually transmitted infection risks. Gender inequities increased girls' risks for violence and sexual exploitation, whereas boys were more prone to running away.

**Conclusion** We found that climate change exacerbated resource insecurities that may drive SRH outcomes among YA in Kenya. We developed a conceptual model to illustrate these pathways linking climate change, EWEs, resource insecurities and SRH. Climate-informed interventions should consider these pathways within larger social environmental contexts to advance young adolescent SRH in Kenya.

#### WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ There is a growing evidence based on the linkages between climate change-related factors, such as extreme weather events (EWEs), and poorer sexual and reproductive health (SRH) outcomes among adults. Yet significant knowledge gaps remain regarding pathways between various EWEs and SRH outcomes across low and middle-income country populations and regions.
- $\Rightarrow$  Young adolescents aged 10–14 comprise half of the world's 1.2 billion adolescent population yet are under-represented in global climate change and SRH research.
- ⇒ Although Kenya is at the nexus of the 'triple threat' of adolescent pregnancy, new HIV infections, and sexual and gender-based violence—in addition to climate change and related EWEs—there is little known about young adolescents' experiences of climate change-related factors in relation to SRH in Kenya.

#### WHAT THIS STUDY ADDS

- ⇒ This study highlights both direct (eg, drought leading to crop failure and food shortage) and indirect pathways (eg, livelihood disruptions that increase economic hardship) from climate change and EWEs to resource insecurities, and in turn to poor SRH outcomes including sexual and gender-based violence, unplanned pregnancy and sexually transmitted infections (STIs) among young adolescents in six climate-affected regions in Kenya.
- ⇒ By emphasising the interconnectedness of ecological (eg, EWEs), economic (eg, poverty) and social (eg, gender inequity) factors, this study introduces a conceptual model to understand the shared and distinct pathways between EWEs, multiple resource insecurities and SRH outcomes, offering critical insights for future research and interventions focused on young adolescents.



### HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Knowledge generated from this research can be used to inform programmes and policies in Kenyan climate-affected regions for young adolescents to address multiple and often co-occurring resource insecurities (food, water, sanitation) to reduce risks of school dropout, menstrual management challenges and running away from home, as well as to develop gender-transformative and youthcentred solutions for reducing transactional sex and exploitative relationships, teen pregnancy and HIV/STI vulnerabilities.

#### BACKGROUND

There is increasing attention to the effects of climate change and related extreme weather events (EWEs)<sup>1</sup> on sexual and reproductive health (SRH) outcomes.<sup>2-5</sup> Climate-related stressors and EWEs, for instance, may exacerbate sexual and gender-based violence (SGBV) through complex pathways including infrastructure damage, poverty and exacerbated gender inequities.<sup>236</sup> Drought is associated with barriers to HIV testing, potentially through increased economic challenges. Population-based studies across African countries document associations between drought and higher HIV prevalence, particularly among adolescent girls and women in rural settings.<sup>4 8</sup> Hypothesised pathways from climate change and related EWEs to HIV vulnerabilities include migration and displacement, poverty, health infrastructure damage and increased SGBV; these factors may increase transactional sex, HIV and sexually transmitted infection (STI) exposure, and widen sexual networks.<sup>29-11</sup> Yet there is limited knowledge of the lived experiences of climate change and SRH among young adolescents (YA) aged 10–14 in high HIV prevalence contexts.<sup>12</sup> Indeed, climate change and health research with children and YA largely addresses physical and mental health with scant attention to SRH.<sup>1213</sup>

In Sub-Saharan Africa, girls aged 15–19 account for >80% of new HIV infections among adolescents.<sup>1415</sup> Nevertheless, YA aged 10–14 are neglected in SRH research, even as they are in a critical transition period that shapes long-term health outcomes<sup>16 17</sup> and comprise half of the 1.2 billion adolescent population.<sup>18</sup> While climate change-related child health outcomes such as infectious diseases and mental health are well documented,<sup>13 19 20</sup> SRH remains overlooked.<sup>12</sup> YA are also understudied in climate change<sup>21 22</sup> and resource insecurity research.<sup>23</sup> Yet resource insecurities such as food insecurity are exacerbated by EWEs and have direct and indirect pathways to SRH.<sup>9 24 25</sup>

Youth are Kenya's fastest growing group<sup>26</sup><sup>27</sup>: young people <15 years comprise 39% of the population.<sup>28</sup> Youth aged 15–24 accounted for 41% of Kenya's new HIV infections in 2022, with adolescent girls and young women comprising 78% of these infections.<sup>29</sup> Adolescents in Kenya face ongoing challenges including SGBV, early marriage and teen pregnancy.<sup>28 30 31</sup> In fact, adolescent pregnancy, new HIV infections and SGBV are

coined Kenya's 'triple threat',<sup>32</sup> yet are understudied at the nexus of climate change. Kenya is a salient context to examine climate change and SRH, as it is experiencing increased flood events and drought.<sup>33 34</sup> Extreme rainfall and flooding lead to mudslides, landslides and soil erosion, which reduce agricultural yields and increase food insecurity.<sup>33–35</sup> Compounding these issues, Kenya is affected by the Greater Horn of Africa's historic 4-year drought<sup>36</sup>—and more recently El-Niño rains and flooding.<sup>37</sup> Nearly one-third (32%) of Kenya's ~53 million population use unimproved water sources and 48% lack basic sanitation services.<sup>38</sup>

There are critical knowledge gaps regarding YA's experiences of the nexus of climate change, resource insecurities and EWEs. YA are more vulnerable to, and negatively affected by, climate change and EWEs, as they are in a critical life phase with major social, physical and cognitive transformations with limited access to socioeconomic resources and power.<sup>22 39 40</sup> Thus, young adolescence is a pivotal transition time from childhood to older adolescence for adolescent sexuality development.<sup>17 39 41</sup> Understanding YA's SRH experiences in the context of climate change and EWEs can guide tailored, climate-informed SRH programmes.<sup>21 22</sup> To address these knowledge gaps, this study aimed to generate understanding of the associations between climate change, EWEs, resource insecurity and SRH among YA in six climate-affected Kenyan regions.

### METHODS

#### Reflexivity

To address our team's positionalities in relation to this research process, we describe our team composition and perspectives in our reflexivity statement (online supplemental material 1).

#### **Study sites**

Six study sites were selected in climate-affected regions in Kenya, leveraging our team's existing collaborations and aiming to generate evidence across diverse ecological, social and cultural contexts: (1) Mathare (population: 206 564),<sup>42</sup> a Nairobi slum: Nairobi's slums experience unique climate change impacts,<sup>43</sup> including microclimates, in environments characterised by dense tin housing, limited vegetation and constrained public utility access,<sup>44</sup> including toilet shortages that exacerbate SGBV vulnerabilities<sup>45</sup>; (2) Kisumu (population: 1 555 574)<sup>42</sup> and nearby fishing communities on Lake Victoria's shore are impacted by food insecurity, poor water and sanitation, and erratic rainfall,<sup>46</sup> (3) Isiolo (population: 268 002)<sup>42</sup>, in semiarid Northern Kenya, is home to nomadic and pastoralist communities who experience livelihood challenges due to variable rainfall, water insecurity and frequent droughts<sup>47 48</sup>; (4) Naivasha (population: 355 383)<sup>42</sup> on Lake Naivasha is home to flower farm workers and internally displaced families impacted by rising lake waters and flooding<sup>49</sup>; (5) Kilifi (population:

1 453 787)<sup>42</sup> and its coastal smallholder farms experience frequent EWEs, low crop productivity and climate and weather changes;<sup>46 50</sup> and (6) *Kalobeyei Refugee Settlement* in Turkana County in northwestern Kenya experiences cyclical drought, changed climate patterns<sup>51</sup> and food insecurity<sup>52</sup> that impacts >59 000 refugees.<sup>53</sup>

#### Study design

This multimethod qualitative study, conducted in 2022–2023 (methods previously described),<sup>54</sup> involved elder focus groups (EFGs), YA walk-along interviews (WAIs) and YA participatory mapping workshops (PMWs). Combining multiple qualitative methods reflects *intra-paradigm* research that can produce rich, comprehensive insights into social processes and dynamics.<sup>55</sup> While the overarching objectives across methods were consistent, specific questions varied to align with the expertise and lived experiences of each group. Elders contributed intergenerational and ecological insights, while YA provided immediate, first-hand lived perspectives.

First, we conducted two EFGs in each site (one with men and one with women), resulting in a total of 12 EFGs across the six sites. The guiding question was: *How does climate change impact young adolescent well-being and SRH?* We began with elders to gain insights into traditional ecological knowledge<sup>56</sup> and intergenerational perspectives.<sup>21 57 58</sup> Elders in Kenya are often involved in health research due to their community knowledge.<sup>59</sup>

Next, we carried out 10 WAIs per site with YA aged 10–14 (five with boys and five with girls), totalling 60 WAIs. The guiding question was: *How do young adolescents navigate and experience access to essential resources such as food, water and toilets*? WAIs explored socioenvironmental<sup>60</sup> influences on well-being through visual recordings and oral narrations of spatial environments where young adolescents access these resources. Walk-along methods provide an understanding of lived experiences in a target environment, including microscale environmental and contextual factors.<sup>61–63</sup>

Finally, in each study site, we held two 2-day YA PMWs, one with 10 boys and the other with 10 girls, leading to a total of 12 PMWs across all six sites. PMWs were guided by the question: *What priorities and recommendations do young adolescents identify for addressing climate change and resource insecurity in their communities*? These workshops engaged YA in collaboratively developing maps that identify linkages between local places and experiences with the goal to advance social change.<sup>64</sup> Our PMW processes involved sharing WAI videos and photos; collectively drawing/annotating maps<sup>54</sup>; adding emoji stickers<sup>65</sup> to photos/maps and verbally describing emotions toward the visual data and creating songs with change recommendations (see online supplemental figure 1).

#### **Participants**

We purposively sampled participants through collaborations with Kenyan community-based organisations (CBOs) leading study implementation (Centre for the Study of Adolescence (CSA), Elim Trust (ET)). CSA recruited participants in Kisumu, Kilifi and Naivasha; ET worked in Mathare, Isiolo and Kalobevei. Both CBOs worked with existing collaborations in schools, health, environmental and social service agencies to purposively sample participants and hired a community researcher in each site to support recruitment using criterion sampling, whereby persons were selected based on their knowledge and experience with the phenomenon being studied.<sup>66</sup> YA participant eligibility criteria were: ages 10-14; living in study site; speaking English, Swahili or Luo and able to provide informed assent with parental or guardian consent. Parents or guardians provided written consent, after which YAs signed assent forms to confirm their voluntary participation. Elder eligibility criteria were self-identifying as an elder, identified by community collaborators as a community elder, and/or aged >55 years; speaking Swahili or Luo. All invited participants agreed to participate.

#### **Data collection processes**

Two trained Master's/Doctoral-level researchers from CBO collaborators alongside a community researcher cofacilitated EFGs, WAIs and PMWs in Swahili or Luo. Doctoral-level academic collaborators supported participatory mapping in Mathare, Kalobeyei and Kisumu. EFGs were audio-recorded, transcribed verbatim, translated and shared with CBOs for verification. EFGs were approximately 60–90 min in duration and conducted in local CBOs.

WAIs were conducted by a trained CBO researcher and community researcher. First, a 30–45 min walking route to water, food, and/or sanitation sites in their community was planned. Next, YAs used wearable (Go-Pro camera) or carried (tablet) technology and walked the team to each site while recording, and on arrival took photos and described their experiences. Site descriptions were audio-recorded along with video recordings.

PMWs were facilitated by two trained CBO researchers and a community researcher in local CBOs. Visual data (maps, photos, emoji stickers (e.g., happy, sad faces))<sup>65</sup> and audio recordings of young adolescents describing these visual data and songs were collected. Audio recordings were transcribed verbatim, translated and verified with the CBO teams.

In Kenya, the mask mandate was lifted on 11 March 2022, and there were no restrictions on gatherings at the time of data collection. However, to ensure participant safety, hand sanitisers and masks were made available. Additionally, many activities were conducted outdoors and the team adhered to national public health protocols.

#### Analysis

Transcriptions and video data were uploaded to Dedoose<sup>67</sup>–cloud-based software that facilitates group coding—anonymised and coded by at least three trained researchers. We conducted codebook thematic analysis following the framework approach<sup>68</sup> <sup>69</sup> that emphasises

systematic coding and analysis based on a structured codebook.<sup>68–70</sup> Six parent codes (sexual/reproductive health and rights; food; mental health; climate change; social dynamics; and water, sanitation and hygiene (WASH)) were developed, and each parent code included between two to five child codes, resulting in 21 child codes. Both deductive and inductive analyses were used. Deductive analyses were informed by the resource insecurity framework's conceptualisation of the ways that ecological factors converge with socioeconomic and social factors (such as gender norms) to shape experiences of food and water insecurity.<sup>71 72</sup> Inductive analysis identified child codes that reflect emergent, bottom-up themes within the data. For instance, while we deductively examined quotations relevant to the parent theme of food insecurity, the ways that food insecurity was discussed in the data were analysed inductively and generated child codes without preconceived categories (eg, youth running away from home due to food insecurity).

The framework approach included familiarisation with the data; systematic coding based on a predefined codebook; organising coded data into a framework matrix for comparative analysis; identifying patterns and relationships and mapping themes to develop a comprehensive narrative supported by exemplar quotations.<sup>70</sup>

Coding discrepancies were reviewed by a fourth reviewer, resolved through team discussions and recoded with consensus. The iterative process continued until thematic saturation was achieved. To ensure contextual relevance and accuracy, collaborating CBOs provided feedback on the findings. Dedoose facilitated examination of the occurrence of themes by data sources, sites and gender through visual displays.<sup>67</sup> We created a visual display to portray the occurrence of themes by gender, method and site, presented below. For this paper, we present data on YA SRH.

#### Findings

Participants (n=297) included: n=119 elders (mean age: 60.6 years, SD: 7.9; men: 48.7%, women: 51.3%), n=60YA WAI participants (mean age: 13.4, SD: 1.5; boys: 51.4%, girls: 48.6%) and n=118YA PMW participants (mean age: 12.1, SD: 1.3; boys: 50.8%, girls: 49.2%) (see table 1).

Participant narratives revealed that climate-related changes increased food, water and sanitation insecurities, with each resource insecurity linked to unique and overlapping SRH vulnerabilities. While climate change was described as causing some of these resource insecurities, others described it exacerbated existing resource insecurities. Table 2 offers a summary of our findings by location, data collection method, gender and participant type to highlight the patterns in perspectives between elders and YA on SRH issues within the context of food, water and sanitation insecurity. Elders predominantly focused on systemic and long-term consequences, such as vulnerabilities to exploitative relationships and transactional sex, alongside the resultant risks of unplanned adolescent pregnancies and STIs. In contrast, YA provided more immediate perspectives, emphasising challenges such as education disruptions and daily SGBV risks, especially when accessing essential resources. Women and girls were more inclined to discuss SGBV and exploitative relationships than men and boys. Shared across regions were concerns regarding menstrual management and SGBV. Regional variations were also noticed, with food insecurity most commonly reported in Isiolo, Mathare and Naivasha. Water insecurity themes were predominantly identified in Mathare, Kalobeyei and Isiolo, while sanitation insecurity themes were most frequently reported in Mathare, Kalobeyei and Naivasha.

# Theme 1. Climate and extreme weather pathways to resource insecurities

As illustrated in table 3, participants described climate change contributed to EWEs such as drought, extreme heat and heavy rain. These EWEs sometimes co-occurred (e.g., drought and extreme heat) and exacerbated preexisting food and water insecurity through multidimensional pathways. In addition to EWE, seasonal changes also resulted in variable water access. Climate change and EWE exerted multifocal effects on access to food. First, drought and extreme rain were both indicated as EWEs that caused food and water insecurity. Drought drove water insecurity and resulted in challenges accessing drinking water and water for crops: You know, water is life. We really need that water...especially during drought' (WAI, Isiolo, boy, aged 11, ID#411). Drought and heavy rain both negatively harmed agricultural production and in turn increased food insecurity: 'When there is a lot of sun, we cannot get healthy things. Sometimes the sun dries up our fruits and vegetables and when there are floods or a lot of rains the floods carry away our food and we are left with hunger' (WAI, Naivasha, girl, aged 11, ID#609).

Extreme heat was another EWE linked with water insecurity-through increasing water-related needs-and presented challenges in accessing food. Drought-related extreme heat made it difficult to walk far distances to stores/markets, and increased food prices. Heavy rain contributed to food insecurity through store closures and destroying crops and agriculture. As a YA girl described: 'When it rains, many of the shopkeepers won't open their shops because it's cold and there's a lot of mud' (WAI, Kalobeyei, girl, aged 12, ID#506). Rainy season runoff additionally contributed to water insecurity through contaminating water sources. Participants also raised issues regarding new climate-related diseases affecting farmers' crops, and climate and weather changes negatively impacting maize crop production and fish stock, exacerbating food insecurity.

#### Theme 2. Food insecurity and pathways to SRH

Food insecurity was described as leading to YA running away from home, sexual and SGBV, transactional sex and exploitative relationships, and in turn, young adolescent pregnancy and STI risks.

Table 1         Sociodemographic characteristics of study participants in Kenya (n=297) by location and methodology											
Sociodemographic characteristics of elder focus group participants in Kenya by location (n=119)											
	Isiolo	(n=18)	Kalobe	eyei (n=19)	Kilifi	(n=20)	Math	are (n=18)	Na	aivasha (n=20)	Kisumu (n=24)
Variable	n (%)		n (%)		n (%	5)	n (%)		n	(%)	n (%)
Age (years)	Mean: 8.4	65.8 SD: Mean: SD: 8.		56.3 Mean: 56. 4 SD: 6.5		ın: 56.2 6.5	Mean: 57.9 SD: 5.7		M SI	ean: 63.2 D: 6.9	Mean: 64.2 SD: 6.9
Gender											
Man (cisgender)	8 (44.4	4%)	10 (52	.6%)	10 (	50%)	9 (50	%)	9	(45%)	12 (50%)
Woman (cisgender)	10 (55	.6%)	9 (47.4%)		10 (50%)		9 (50%)		11 (55%)		12 (50%)
Educational status	(missing n=	=1)									
No formal education	18 (10	0%)	3 (15.8	3 (15.8%)		0 (0%)		1 (5.9%)		(0%)	0 (0%)
<secondary< td=""><td>0 (0%)</td><td>)</td><td colspan="2">11 (57.9%)</td><td colspan="2">18 (90%)</td><td colspan="2">10 (58.8%)</td><td colspan="2">9 (45%)</td><td>16 (66.7%)</td></secondary<>	0 (0%)	)	11 (57.9%)		18 (90%)		10 (58.8%)		9 (45%)		16 (66.7%)
Completed secondary	0 (0%)	)	1 (5.2%)		1 (5%)		4 (23.5%)		5 (25%)		6 (25%)
College/ university+	0 (0%)	)	4 (21.1	%)	1 (59	%)	2 (11.	.8%)	6	(30%)	2 (8.3%)
Mobile phone (missing	g n=1)										
No	8 (44.4	4%)	5 (26.3	5 (26.3%)		0 (0%)		0 (0%)		(0%)	1 (4.2%)
Yes	10 (55	.6%)	14 (73	(73.7%)		19 (0%)		18 (100%)		0 (100%)	23 (95.8%)
Employment status	(missing r	1=5)									
No employment/ 13 (72.2%) retired		.2%)	14 (73.7%)		3 (15%)		3 (17.6%)		7 (36.8%)		14 (66.7%)
Employed (part/ fulltime)	5 (27.8	3%)	5 (26.3	3%)	17 (8	85%)	14 (82	2.4%)	12	2 (63.2%)	7 (33.3%)
Sociodemographic characteristics of young adolescent walk-along interview participants in Kenva by location (n=60)											
		lsiolo (n=1	0)	Kalobevei		Kilifi (n=9)		Mathare	_	Naivasha	Kisumu
			-,	(n=10)		(		(n=11)		(n=10)	(n=10)
Variable		n (%)		n (%)		n (%)		n (%)		n (%)	n (%)
Age (years) (missing n=	-4)	Mean: 13.9 1.8	9 SD:	Mean: 13.6 SD: 0.9	6	Mean: 13.1 1.4	SD:	Mean: 13.1 SD: 1.9		Mean: 13.5 SD: 1.6	Mean: 13.3 SD: 1.8
Gender											
Young adolescen	it boy	5 (50%)		5 (50%)		5 (55.6%)		5 (45.4%)		5 (50%)	5 (50%)
Young adolescen	ıt girl	5 (50%)		5 (50%)		4 (44.4%)		6 (54.6%)		5 (50%)	5 (50%)
Currently in school											
No		0 (0%)		0 (0%)		0 (0%)		0 (0%)		0 (0%)	1 (10%)
Yes		10 (100%)		10 (100%)		9 (100%)		11 (100%)		10 (100%)	9 (90%)
Mobile phone (missing n=5)											
No		9 (100%)		10 (100%)		0 (0%)		11 (100%)		4 (66.7%)	0 (0%)
Yes, Shared		0 (0%)		0 (0%)		9 (100%)		0 (0%)		2 (33.3%)	10 (100%)
Toilet access (missing n=9)											
Private yard/mud		1 (11.1%)		7 (70%)		0 (0%)		1 (9.1%)		0 (0%)	9 (90%)
Public/communit toilets	У	7 (77.8%)		3 (30%)		1 (11.1%)		10 (90.9%)		0 (0%)	0 (0%)
In-house toilet		0 (0%)		0 (0%)		8 (88.9%)		0 (0%)		1 (50%)	1 (10%)
Outside		1 (11.1%)		0 (0%)		0 (0%)		0 (0%)		1 (50%)	0 (0%)
Water sources (missing	ng n=11)										

Continued

Table 1 Continued

2 (22.2%)

4 (44.5%)

2 (22.2%)

1 (11.1%)

Kisumu (n=18)

n(0/2)

0 (0%)

#### Sociodemographic characteristics of young adolescent walk-along interview participants in Kenya by location (n=60) Piped household 0 (0%) 1(11.1%)4 (44.4%) 2 (18.2%) 2 (100%) 2 (22.2%) 0 (0%) 0 (0%) 0 (0%) Water pump 1 (9.1%) Natural source 1(11.1%)1(11.1%)0 (0%) 0 (0%) 0 (0%) **Borehole** 2 (22.2%) 2 (22.2%) 4 (44.4%) 0 (0%) 0 (0%) Public tank/truck 4 (44.5%) 8 (72.7%) 0 (0%) 5 (55.6%) 1 (11.2%) Sociodemographic characteristics of young adolescent participatory mapping workshop participants in Kenya by location (n=118) Isiolo (n=20) Kalobevei (n=20) Kilifi (n=20) Mathare (n=20) Naivasha (n=20) n (%) n (%) n (%) n(0/2)n(0/2)Variabla

v	anable	11 (70)	11 (70)	11 (70)	11 (70)	11 (70)	11 (70)
A	ge (years)	Mean: 11.65 SD: 1.42	Mean: 12.75 SD: 0.97	Mean: 12.25 SD: 1.37	Mean: 12.3 SD: 1.39	Mean: 12.15 SD: 1.46	Mean: 11.94 SD: 1.16
G	lender						
	Young adolescent boy	10 (50%)	10 (50%)	10 (50%)	10 (50%)	10 (50%)	10 (55.6%)
	Young adolescent girl	10 (50%)	10 (50%)	10 (50%)	10 (50%)	10 (50%)	8 (44.4%)

missing n, number of missing responses.

#### Food insecurity and running away

Food insecurity was described as a driver for young adolescents running away from home. An elder explained household-level poverty and parents' hopelessness as barriers to raising children 'well'. Others described that young adolescents would run away due to frustrations with household poverty that interrupted their educational access and caused hunger:

'There are the children who drop out of school and go loitering...They will tell you things like: 'We have no money for school uniform, no money for school fees, no money for food, so what do you want me to do? I am big boy now and can go where I want, so leave me to it' (EFG, Isiolo, women)

Food insecurity was commonly described as a root cause for street-involvement among children: 'I heard of a boy who lacked food and slept hungry for two days, he ran away from home and went into town and became a street urchin. (He was) around 10 or 12' (WAI, Isiolo, boy, aged 12, ID#407). Running away was most commonly described among boys.

#### Food insecurity and SGBV risks

Food insecurity was linked with SGBV risks in the context of acquiring food. Young adolescent girls described experiencing sexual harassment in crowded stores and food markets, which was exacerbated at night: 'There was one evening some girls were sent to the shop by their mum and on their way back, as it was late, they came across bad men and they were raped. I think one was 15 years and the other 12 years' (WAI, Isiolo, girl, aged 14, ID#406).

Others discussed how household poverty, food insecurity and unpaid school fees converged to increase exposure to sexual exploitation:

'The women go to hustle. They leave at about 6:00 or 7:00 and get back at 19:00. During the day they expect that their child has gone to school. On getting there, school staff realise the child's school fee is not paid, and they are sent back home. On getting home, the house is locked, so the child starts loitering. At lunch, they get hungry and look for food. At this point, they might come across a random man who will lie and lure them through a meal of chips, or whatever...what comes next unfortunately is rape, or sexual assault. It happens' (EFG, Mathare, men).

#### Food insecurity, transactional sex and exploitative relationships

Food insecurity contributed to transactional sex and exploitative relationships, particularly among YA girls, in turn contributing to unplanned pregnancy. Due to hunger, YA girls may exchange sex for food, including age-disparate transactional sex:

'The girls will skip school and go to a man's house-a man old enough to be their father or grandfather. And why is this the case? This girl probably lives in poverty. Just 20 shillings (\$0.15 USD) to buy chips and that's enough to keep her going to satisfy her hunger or needs. Before we know it, this girl at the age of 14/16 years will get pregnant. Poverty is really a great issue' (EFG, Mathare, women).

Young adolescents shared how food insecurity can result in transactional sex initiated by a YA girl and/or her parents. Others recommended that schools provide food to children to avoid sexually exploitative relationships.

Food insecurity and risks for young adolescent pregnancy and STI Unplanned young adolescent pregnancy and STI were described as resulting from exploitative sexual relationships and transactional sex. This was discussed as an urban phenomenon, among those living in crowded

method and gender									
Theme	Sexual and reproductive health issue	Method	Isiolo	Kalobeyei	Kilifi	Kisumu	Mathare	Naivasha	
Food insecurity	Young adolescents run away from home	EFG	W, M	М			W		
	due to food insecurity.	WAI	М						
		PMW							
	Young adolescents face sexual and gender-	EFG					М	W	
	based violence risks when accessing food.	WAI	W	W		W	W, M		
		PMW		W				W	
	Food insecurity leaves young adolescent	EFG	W, M		W, M	М	W, M	W, M	
	girls and women, in particular, vulnerable to exploitative relationships and transactional	WAI	W, M				W		
	sex.	PMW		W				W	
	Unplanned young adolescent pregnancy and STIs are frequently an outcome of exploitative relationships and transactional	EFG	М		W, M	М	W, M	W, M	
		WAI	W						
	sex.	PMW						W	
Water	Young adolescents experience educational disruption.	EFG	W, M	М			W, M		
insecurity		WAI	W, M	W, M			W		
		PMW		М					
	Young adolescents face sexual and gender- based violence risks when accessing water.	EFG							
		WAI	W	М	М	М	W, M		
		PMW		М		W, M			
	Water insecurity leaves young adolescent	EFG					М		
	girls and women, in particular, vulnerable to exploitative or transactional relationships/	WAI		W					
	dynamics.	PMW		W					
Sanitation	Young adolescent girls and women	EFG	W, M	М	W	W	W, M	W	
insecurity	experience menstrual management	WAI	W, M	W	W		W, M	W	
	chalongoo.	PMW			W		W	W	
	Young adolescents face sexual and gender-	EFG		М					
	based violence risks when accessing toilets and showers	WAI	W	W, M	М	W, M	W, M	W	
		PMW				М	W, M	W, M	
	Sanitation insecurity increases young	EFG	W	W, M	W		W, M	W, M	
	adolescents' vulnerability to exploitative or transactional relationships/dynamics	WAI					W		
	a a louotona rolatonompo/ dynamios.	PMW							

 Table 2
 Findings on sexual and reproductive health issues by food, water and sanitation insecurity, location, data collection method and gender

Participant type: EFG, WAI, PMW, women and girls (W), men and boys (M). Colour legend: Green: both men/boys and women/girls mentioned; orange: woman/girls alone mentioned; blue: men/boys alone mentioned. EFG, Elder Focus Group; PMW, Young Adolescent Participatory Mapping Workshop; STI, sexually transmitted infection; WAI, Young Adolescent Walk-along Interview.

W, M

W

EFG

W/AI

PMW

informal settlements, and in rural communities. An elder

'There's been a lot of things that have surprised us. A child as young as eight, let alone 10 years, could get pregnant. We don't understand. At times it could be as a result of the state of things in her home. A man will deceive her through simple things like mandazi (fried bread) and sweets and she will be convinced just like that. It's shocking for a parent. The worst was during Covid' (EFG, Isiolo, men).

Unplanned young adolescent pregnancy

transactional relationships/dynamics

described:

is frequently an outcome of exploitative or

Several narratives noted increased young adolescent pregnancy during the pandemic. Others reinforced the small amount of food that could lead to transactional sex and early pregnancy if food insecurity is not addressed. Food insecurity may also result in early/child marriage: 'some girls choose to get married so as to deal with such situations as food shortage and hunger' (WAI, Isiolo, girl, aged 11, ID#406). Others noted STI risks resulting from food insecurity-related transactional sex:

W

W

Μ

'The adolescent has sex with the boy just to get one kangumu (half-cake) so that she can add to what the mother (gave her). The boy will leave the girl and go to another and another. And in that state, they end up contracting the disease that causes cervical cancer... HPV. HPV develops slowly; you will hear that there is an outbreak of diseases. And all that is caused by the drought' (EFG, Naivasha, women).

Theme	Example	Illustrative quotations				
Climate change and ncreased resource insecurity	Drought	<ul> <li>'We usually lack water and during drought time many people use a lot and it gets finished, when this doesn't have water, (there are) water problems, lack of water. No drinking water.' (WAI, Naivasha, boy, aged 13, ID#606)</li> <li>'Did you see cows on the road? Goats? Donkeys? We don't have any livestock left here. Have you seen any green fields? Look at our land. Is there anything we can grow here? No. There's no water! No water for crop, no water to drink. That's a big issue here. It hurts a lot. We don't even know where to start.' (EFG, Isiolo, men)</li> <li>'Like there is drought, there will be no food, all vegetables will dry and there will be no food; and if rain in excess, vegetables will be washed away. If there is an average rain and sunshine all vegetables will grow well.' (PMW, Naivasha, girl)</li> <li>'When there will be an increase in the price of the commodity. If there is a lot of rain, there will be a destruction of farm produce; some of them (produce) get rotten due to heavy rains, the road</li> </ul>				
	Extreme heat	<ul> <li>(we recommend) 'For water to be brought, especially here you can see it gets so dry! The air isn't good, plus the sun. The first time we came to this camp we were always being taken to hospital. We weren't used to such intense heat and sun.' (WAI, Kalobeyei, boy, aged 12, ID#507)</li> <li>(I feel) 'Sad because I have to walk for long distance and the sun burns you and also get dusty. The food prices have also gone up.' (PMW, Isiolo, girl)</li> <li>(Describing the borehole) 'There's the solar panels. They actually get too hot. The sun is usually very hot in the dry months and so sometimes the panels overheat and can cause electrocution. Due to the level of heat, they lose their efficiency and the water does not pump up well. In such times it will over pump and we will not get good water.' (WAI, Isiolo, boy, aged 11, ID#411)</li> </ul>				
	Heavy rain	'During the rainy season, water at that time is not clean and is polluted with mud.' (WAI, Kisumu, boy, age 12, ID#203) 'This place when it rains: the water is always dirty and it always destroys farms because the water may be a lot and destroys the farms close to the river.' (WAI, Kisumu, boy, aged 13, ID#201)				
	Climate change and reduced food access	'The diseases, come through climate [change), if you will plant and fail to get maize, that's where you will find that things get worse because I don't have food.' (EFG, Kilifi, men) 'Climate change has led to a reduction of fish' and 'the rains are contributing to the reduction of fish because it's (needed) for the rains to come, the fish to feel cold down there and hence come up. But if it doesn't rain, the fish will not come up.' (EFG, Kilifi, women)				

Table 3 Climate change and linkages with resource insecurities among young adolescents in climate-affected regions in Kenya

EFG, Elder Focus Group; PMW, Young Adolescent Participatory Mapping Workshop; WAI, Young Adolescent Walk-along Interview.

#### Theme 3. Water insecurity and pathways to SRH

Water insecurity was associated with educational disruption, sexual violence risks, transactional sex and exploitative relationships (table 4). Heavy rains were raised as particularly dangerous for young adolescent girls due to elevated sexual violence exposure due to infrastructure damage and displacement.

Water insecurity, flooding and educational disruption

Participants noted that water insecurity contributed to lower school attendance due to young adolescents' inability to bathe and wash uniforms: 'when this child arrives home, he has no water, he wants to go to school, there is no water to wash clothes. For the toilet, it's dirty. If you wash clothes, the toilet is dirty. That doesn't work'

 Table 4
 Resource insecurities and pathways to sexual and reproductive health outcomes among young adolescents in climate-affected regions in Kenya

Theme	Subtheme	Illustrative quotations				
Food insecurity	Food insecurity and running away	'The street children (chokoraa) come to buy gum in my area. They will then just linger in that area. Nearly all of Mlango kubwa too. A mix of girls and boys. They will sleep outside the shops. Our children will flee their homes due to poverty to live on the streets. They will collect metal, plastic bottles and go and sell them just to have 50 shillings to buy the gum.' (EFG, Mathare, women) 'Lack of food has caused some children to run away from home.' (WAI, Isiolo, boy, aged 12, ID#407				
	Food insecurity and SGBV risks	'Interviewer: What is interesting about this place where you buy 'Githeri'? (corn and bean meal) Young adolescent: Sometimes there are challenges sometimes you are so frightened you just send an older sibling - when I see a man, I send my sister. Sometimes they ask you various things and you don't know them.' (WAI, Mathare, girl, aged 14, ID#106) 'Parents should not send girls to the market at night because they are a high risk for rape and other gender-based violence.' (PMW, Kalobeyei, girl)				
	Food insecurity and transactional sex and exploitative relationships	'The adolescents are affected because the parents, let's say the schools are closed, the parent got something small and cooked for the children then she went to work again leaving the adolescents behind. Because they haven't eaten enough, they will have to go and lookif it's a girl, they will go and look for a boy, and for example, the boy was given 100 shillings (equivalent to \$0.77 USD) by the father. He will trick the girl and buy her soda. The soda that cost 30 shillings will have its results because the girl didn't eat enough at home.' (EFG, Naivasha, women) 'There are some girls, who cannot fend for themselves and have possibly slept hungry so it seems it is their only option. They end up sleeping with men so they can get some money in order for them to eat.' (WAI, Mathare, girl, aged 14, ID#106)				
	Food insecurity and risks for young adolescent pregnancy and STI	'As our children grow, especially the girl child, it's not the same as in the countryside. They have their agemates neighbouring them so closely. We find that on the level of maturity, they mature very fast because of the immense challenges they encounter here. They face deception through things like being lured by sweets in fact recently, there was a lot circulating on the news concerning young girls getting pregnant during the pandemic. Upon investigation this was found to have taken place more so in the overcrowded regions.' (EFG, Mathare, men) 'Right now in Nyahera here, we have a high rate of teenage pregnancies, if you go to the hospital, they report that every week. If the food is not good, and no money is coming in, so the children must have something that they want. Therefore, some people take advantage.' (EFG, Kisumu, men)				
Water insecurity and pathways to SRH	Water insecurity and educational disruption	'They (girls) will not go to school and remain home until they can access water.' (WAI, Isiolo, boy, aged 12, ID#407) 'When asked by the teachers, some say they were told not to go to school, others say they were sick and others say their clothes were dirty. Sometimes during school assembly if there are students like those, they are picked out and told to go back home, take a shower, wash their clothes and come back to school the next day.' (WAI, Isiolo, boy, aged 13, ID#409)				
	Water insecurity and SGBV risks	'You find someone is late from work in the evening, now he is coming home. When he goes to Laga [water point), he meets those who are staying there, they rape them, especially our mothers and our sisters.' (PMW, Kalobeyei, boy) 'People don't like coming here at night (water point) it is very quiet here, people don't like passing by here at night.' (WAI, Mathare, girl, aged 14, ID#106)				
	Water insecurity and transactional sex and exploitative relationships	'She will go to a man's place or boy's place, stay there, bathe while there As she goes on to do so, she'll note the great difference between this place and her home and all its inconveniences. What follows is unwanted pregnancies, early marriage.' (EFG, Mathare, women) 'I put a sad face (emoji) to see that many people struggled to find water and it makes me very sad to see forcing girls to do bad things (sex) to get water.' (PMW, Mathare, girl)				
Sanitation insecurity	Sanitation insecurity and menstrual management challenges	'There is improper use of the toilet and others don't clean up after themselves. It is a bit embarrassing when there's still blood left because the water was not enough to wash it all away, and there's someone else waiting to use the toilet.' (WAI, Mathare, girl, aged 14, ID#106) (Why do girls miss school?): 'Maybe they don't have pads and are afraid to dirty their clothes.' (WAI, lsiolo, girl, aged 14, ID#404)				
	Sanitation insecurity and SGBV risks	'I put an angry face (emoji) for the bathroom. Sometimes you can go to the bathroom and find that there's holes on the iron sheets surrounding the bathroom. As you're taking your shower, you're not at peace, and you don't feel safe. All you can think about is how there may be someone just there peeping in on you. At times it's even the boys who drill in those holes intentionally!' (PMW, Mathare, girl) 'You get so embarrassed to the point of ensuring you use the toilets at school in the evening, so that you don't have to come here (public toilet). Someone climbed to the top of the toilet (to watch): it made me afraid of using this toilet.' (WAI, Mathare, girl, aged 14, ID#106)				
	Sanitation insecurity and transactional sex	'A girl will feel she has crossed over into adulthood after the time of her first period. She may not have the means to buy pads and so she will look for them. This may be through a boy she knows or through an older man. Ksh 5 here Ksh 10 there to buy these pads. Once she has fallen into this trap, it becomes the norm and sex is definitely the payment for it.' (EFG, Mathare, men) 'If they are given 50 shillings they buy pads because they see that the parents cannot give them and we cannot use the traditional method where women were using the handkerchiefs so you have to buy the pads. So, girls have challenges and that's why they go to the boys so that they can help them.' (EFG, Naivasha, men)				

EFG, Elder Focus Group; PMW, Young Adolescent Participatory Mapping Workshop; STI, sexually transmitted infection; WAI, Young Adolescent Walk-along Interview.

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(EFG, Kalobeyei, men). The effects of water insecurity on school attendance were particularly pronounced for YA girls: 'The girl, as she gets older, it's important for her to keep clean. When there's lack of water, she is unmotivated to go to school. She will feel dirty and encounter low self-esteem, and prefer not to interact with others in school' (EFG, Mathare, women).

Flooding can also result in displacement from one's home, described as contributing to missing school, changes in sexual practices and subsequent heightened pregnancy risks: 'when it floods, the water gets into people's houses, there's children who don't want to go to school. You find young girls getting pregnant and dropping out of school' (WAI, Mathare, girl, aged 11, ID#101). These connections are further detailed in table 4.

#### Water insecurity and young adolescent girls' SGBV risks

Participants described sexual harassment and sexual violence targeting YA girls collecting water. A YA boy recalled: 'There are some girls who were going to Village 2 to fetch water, some men captured them and raped them. It's not a rare occurrence' (WAI, Kalobeyei, boy, aged 12, ID#509). Others discussed how fears of sexual violence resulted in young adolescent girls not collecting water at night.

Participants recounted how infrastructure damage (eg, washed out roads) in the rainy season changes YA's walking routes to school and other resources, increasing exposure to sexual violence. An elder described:

'When it comes to rape of the girl child, cases are much higher, especially in the rainy season. If she goes to school on the other side of the river and gets caught in the rain during late hours, she must find shelter and wait. When the rain stops, it can be late at night. When trying to make her way across the bridge, she finds heinous guy groups who will abduct her, take her to some shack and rape her there. It's a great risk to our girls. It happens frequently, in fact' (EFG, Mathare, men).

Household flooding during extreme rain was also described as a risk factor for sexual violence; young adolescent girls may be displaced, sleep at a neighbour's home and/or could be harassed or attacked.

# Water insecurity and transactional sex and exploitative relationships

Participants noted that water insecurity contributes to young adolescent girls' transactional sex engagement, and/or sexual exploitation, to access water, often resulting in unplanned pregnancy. Young adolescents described hearing about transactional sex for water during menstruation: 'they can't shower because they don't have water, and so they sell themselves so they get water' (WAI, Mathare, girl, aged 12, ID#109). Others described experiences of young adolescent girls' exploitation by vendors when fetching water:

You, as a mother, will not have time to go all the way to Mathare North to buy water. You send your young girl to buy the water. When they arrive, the sellers are not girls but ි

young men. Some allow them to get the water "free". They will tell them to fetch as much as they want, and that they will discuss payment later. They will even exchange phone numbers, because now most of our kids have phones. So, you can imagine this scenario with these boys who have a bunch of friends all over' (EFG, Mathare, men).

#### Theme 4. Sanitation insecurity and SRH

Sanitation insecurity was characterised as causing menstrual management challenges, SGBV risks and transactional sex for menstrual products (table 4).

#### Sanitation insecurity and menstrual management challenges

Climate change-related EWEs, including drought, disrupt livelihoods and create a cascade of economic challenges. As a result, many families are unable to afford menstrual products, clean water or access to safe sanitation facilities, which severely reduces young adolescent girls' ability to manage menstruation through limiting the ability to bathe, wash clothing/menstrual pads and/or purchase menstrual products. As one YA girl shared: 'Imagine as a girl going to the toilet during your periods and having carried water to wash the blood away, which ends up being insufficient. So one is left wondering what to do... As there is no bin to dispose of the pads' (WAI, Mathare, girl, aged 14, ID#106).

The absence of water and menstrual supplies also leads to frequent school absences among girls. One father explained:

'Perhaps girls may need more attention, but as parents, what can we do? The girl just has to survive. You know the girl will see something every month (menstruation) that the boy will not. When it comes, she has to take showers, but if she can't afford to, what can be done? She will do what she has to! If she goes and she's laughed at in school, then oh well, she just has to survive' (EFG, Isiolo, men).

#### Sanitation insecurity and SGBV risks

Participants described risks of sexual and physical violence accessing toilets and showers. Fear of violence was pronounced in the evening, when YAs might avoid using toilets and/or showers. Others discussed avoiding toilets/showers at night due to peeping and voyeurism concerns. Young adolescent girls reported privacy breaches at all times of the day in public toilets used for showering: 'You'll just be minding your business taking your shower, and then a boy passes by peeping in on you. When you're done, later on, that boy will come telling you things like, 'Hey! You know I saw you naked in the bathroom today while you were taking your shower'" (PM, Mathare, girls).

#### Sanitation insecurity and transactional sex

Participants described that YA girls may engage in transactional sex for menstrual management supplies due to familial poverty: 'Let me talk to you as a woman, and in fact as a mother. There are times our girls will come to us for pads, and we can't even afford those, so what do they do? They run to those who can give it to them because of the state of poverty we face' (EFG, Isiolo, women).

This can lead to cycles of long-term transactional sex for menstrual supplies, in turn, contributing to unplanned pregnancy: 'You will find that there are girls who have given birth when they are twelve/thirteen-years-old. They get pregnant to get soap, they go to have sex with men' (EFG, Kalobeyei, men).

Table 4 provides additional illustrative quotes that offer further depth and context to the themes discussed. These quotes reflect shared, different and contextually specific experiences, highlighting the complex interplay between SRH vulnerabilities and resource insecurities across diverse Kenyan contexts.

#### DISCUSSION

Our multi-method study with YA in six climate-affected regions in Kenya indicates that climate change contributes to drought and flooding, directly exacerbating preexisting food, water and sanitation insecurities. Climate change also indirectly drives resource insecurity by worsening poverty,73 74 disrupting livelihoods and deepening economic hardship that reduce the ability of households to afford essential resources.<sup>73 74</sup> Sanitation insecurity has direct (sexual violence risks) and indirect (menstrual management challenges lead to transactional sex, educational disruption and missing school) paths to poorer interlinked SRH outcomes of STIs and unplanned pregnancy. Food insecurity has direct (sexual violence risks, transactional sex) and indirect (educational disruption, running away) paths to these SRH outcomes. Water insecurity also has direct (sexual violence risks, transactional sex) and indirect paths to SRH outcomes, including via increasing sanitation insecurity and educational disruption that also increase transactional sex. Young adolescent girls are disproportionately affected, as gender inequalities contribute to inequitable access to resources, unmet menstrual management needs, HIV and pregnancy prevention needs.<sup>74</sup> Based on these findings, we developed a conceptual model showing pathways linking climate change, EWEs, resource insecurities and SRH with YA (figure 1). Findings signal the urgent need for climate-informed gender-tailored strategies to address co-occurring resource insecurities to advance young adolescent SRH.

Our findings provide insight into YA's sexual violence risks while accessing various resources in contexts of insecurity, and how these risks are shaped by time of day (eg, night), weather (eg, rain), gender (eg, girls' vulnerability) and infrastructure type (eg, toilet/shower materials). This corroborates prior research that EWEs may increase SGBV through broader contexts of economic insecurity and infrastructure damage, household stressors and gender inequity.<sup>3 6 25</sup> Our findings expand on this evidence by articulating shared and distinct pathways to SRH when accessing different resources. Food insecurity heightens risks of exploitative relationships and transactional sex due to household economic pressures. Water insecurity drives violence risks through collection routes, particularly during flooding and displacement, while sanitation insecurity increases risks of voyeurism and harassment due to inadequate privacy in public facilities. Despite these distinctions, resource insecurities share common links to school absenteeism, constrained sexual agency, and increased exposure to exploitative relationships. Our findings reinforce that YA girls' SGBV vulnerabilities during drought<sup>75</sup> extend to heavy rains due to infrastructure damage and displacement.<sup>76</sup> Rain/ precipitation and SGBV among YA are understudied.<sup>2</sup>

Participant narratives commonly discussed how resource insecurities led to transactional sex. This builds on research across Africa among persons aged >15 on how drought and extreme precipitation contribute to food insecurity that increases transactional sex<sup>24</sup><sup>77</sup> and HIV/STI exposure.<sup>977</sup> Our findings that water insecurity was also associated with transactional sex corroborates Ugandan research with refugee youth<sup>78</sup> and is congruent with research on drought and suboptimal HIV outcomes (eg, higher HIV prevalence, poor antiretroviral therapy adherence, reduced HIV testing) in African contexts. 45879 The present findings illuminate that YA exchange sex for water to meet basic hygiene and menstrual needsboth essential to school attendance. Corroborating other Kenyan studies,<sup>80-82</sup> our findings document transactional sex for menstrual supplies.<sup>83</sup> While our findings highlight associations between resource insecurity and transactional sex, its drivers are multifaceted and extend beyond resource insecurity. In Kenva, poverty remains a significant driver of transactional sex, but additional motivations include material aspirations, peer influence and obtaining school fees and supplies.<sup>82 §4</sup> Our findings corroborate Kenvan research that reveals how both transactional sex and sexual violence drive unplanned adolescent pregnancy,85 and research in Sub-Saharan Africa regarding adolescent pregnancy drivers.<sup>86</sup> Adolescent pregnancy increases risks of later HIV acquisition in East Africa<sup>87</sup> through pathways including increases in sex partners,<sup>88</sup> age-disparate sex partners<sup>88</sup> and poverty.<sup>89</sup>

We characterised school interruptions/drop-out as a distal SRH risk factor, as low school attendance/drop-out are associated with increased HIV/STI acquisition<sup>90</sup> and teen pregnancy.<sup>91</sup> Our finding that food insecurity was associated with running away from home aligns with review findings that poverty is a driver of youths' street involvement globally.<sup>92</sup> We categorised running away as a distal SRH risk factor, as street-involved Kenyan youth have low HIV knowledge,<sup>93</sup> and street-involved young women have high HIV<sup>94</sup> and STI<sup>95</sup> prevalence. Running away was discussed mostly among YA boys in our study; this can inform gender-tailored programming.

Participant narratives regarding deceitful interactions for resource acquisition evoke challenges around defining sexual exploitation,<sup>96</sup> and whether YA engaged in transactional sex and/or were sexually exploited. A qualitative Ugandan study noted that etic definitions



Figure 1 Dotted lines: pathways supported by evidence from the literature. Solid lines: pathways derived directly from young adolescent narratives in our study. Colour legend: Green arrows: sanitation insecurity pathways; purple arrows: food insecurity pathways; blue arrows: water insecurity pathways; dark purple arrows: sexual risks and exploitation pathways; and orange rectangles: SRH outcomes. SRH, sexual and reproductive health.

classify all transactional sex with a minor (aged <18) as sexual exploitation, while emic community perspectives characterise transactional sex as sexual exploitation when it involves a lack of consent and/or deceit.<sup>97</sup> This suggests that when young adolescent girls were tricked into taking food/water without understanding sexual expectations, it aligns closer with this emic definition of sexual exploitation compared with situations where girls engage in sex for menstrual pads, where they may be enacting agency within gendered expectations of reciprocity to meet material needs.<sup>96 97</sup>

The present study expands on resource insecurity theory by emphasising the interplay between economic, ecological and social factors in contributing to resource insecurity and in turn well-being.<sup>71 72</sup> By identifying largely shared pathways from multiple resource insecurities to

SRH (figure 1), our findings signal the importance of a broader resource insecurity framework for YA SRH.<sup>71 72</sup> Aligned with the resource insecurity framework,<sup>71 72</sup> we identified ecological (EWE), economic (poverty) and social (gender inequity) factors that shape exposure to food and water insecurity. While the original resource insecurity framework explores pathways to emotional well-being and mental health, our study identifies pathways to SRH and introduces sanitation insecurity as a key resource insecurity dimension to consider. While the original resource insecurity framework focused on household-level food/water insecurity coping strategies (eg, migration),<sup>71 72</sup> our findings identified YA-specific coping strategies (running away, missing school, transactional sex). Few studies have investigated concurrent multiple resource insecurities among young adolescents<sup>98</sup>

across genders, multiple EWE, diverse ecologic contexts, and our findings reveal significant overlaps in the ways that water, food and sanitation insecurities shape SRH outcomes. Moreover, our findings highlight the salience of examining multiple material insecurities to illuminate the health impacts of resource insecurities in climateaffected contexts.

Findings signal several intervention points. Climate change intensifies food, water and sanitation insecurities<sup>33–35</sup> and addressing these issues requires a multilevel approach that includes structural (eg, food policy); institutional (eg, climate-resilient health systems); community (eg, equitable water management) and individual (eg, self-efficacy) level strategies.<sup>10</sup> Gender-transformative programmes that engage boys and men, who were aware in our study of gendered SGBV risks, are needed for violence prevention.<sup>99–101</sup> Reducing menstrual insecurity (eg, menstrual cups/pads provision) can increase young adolescent girls' agency and reduce STI risks.<sup>102</sup> Multisectoral interventions, including agricultural and microfinance programmes, hold promise in reducing transactional sex, increasing school retention and enhancing sexual agency.<sup>103</sup>

#### **Strengths and limitations**

Study limitations include the group format of EFGs and PMWs, which may have resulted in discomfort sharing personal experiences/perspectives. The WAIs did not facilitate in-depth conversations due to the nature of walking in public spaces; thus, we may have missed in-depth young adolescent insights. YA may have felt discomfort discussing SRH with adult researchers, potentially contributing to the richest SRH insights being from elders who themselves have biases. Despite these limitations, our study has several strengths; we included YA, under-represented in climate-related and SRH research; generated diverse perspectives across genders and six climate-affected regions to identify shared and site-specific issues; and our qualitative multi-method approach facilitated triangulation and comprehensive insights across climate, resource insecurity and SRH issues.<sup>52</sup>

#### **CONCLUSIONS**

The intersecting impacts of climate change and resource insecurities demand urgent attention in Kenya. Multilevel approaches that address resource insecurities, young adolescent-tailored SRH priorities, communitylevel SGBV reduction, self-efficacy and agency are needed for YA in Kenya to realise sexual and reproductive health and rights.

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