



Research article

Protecting women's health in a changing climate: The role of community-based adaptation

Emma Duus, Doreen Montag^{*,*}

Unit for Global Health, Wolfson Institute of Population Health, Queen Mary University London, London, United Kingdom

ARTICLE INFO

Article History:

Received 22 December 2021

Accepted 6 February 2022

Available online 10 February 2022

Keywords:

Climate change

Gender

Kenia

Community based adaptation

ABSTRACT

Introduction: Community-based adaptation is an emerging approach to mitigating the health consequences of climate change, yet, the interactions amongst climate change, community-based adaptation, health and gender have not been explored as a single nexus in a low-income setting. The paper uses the Adaptation Learning Programme as a case to explore this nexus. The Adaptation Learning Programme was a gender-integrated community-based adaptation programme implemented from 2010 to 2015 in Garissa County in Kenya.

Methods: A case study methodology with an interpretivist epistemological approach was chosen to explore the complexity underlying the unique context of the Adaptation Learning Programme's implementation in Garissa. Data was collected from grey literature published and was analysed using a systematic framework.

Results: Adaptation Learning Programme community-based adaptation interventions enhanced adaptive capacity, through enhancing women's access to markets and economic assets, teaching women adaptive agricultural practices, including women in decision-making processes, and disseminating gender-sensitive climate information to communities. These processes mitigated several climate-related health risks faced by women in Garissa, but also failed to address the structural causes of their health vulnerabilities. The findings can be scaled up to inform further community-based adaptations and national policies on gender-sensitive approaches to climate change.

© 2022 The Authors. Published by Elsevier Masson SAS. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

1.0. Introduction

Climate change is arguably the biggest global health threat of the 21st century [1], with its health consequences being inherently gendered [2]. Climate-related natural resource depletion causes unequal health detriment to women in many low-income settings, who are ascribed with livelihood roles that rely mainly on natural systems [3]. This calls for gender-sensitive approaches to climate change adaptation [4]. Adaptation is the adjustment of systems in response to actual or expected climate stimuli or their effects which moderates harm [5]. Community-based adaptation (CBA) is an empowering, bottom-up approach to climate change adaptation, which prioritizes local, context-specific needs of adaptation [6]. It aims to enhance communities' adaptive capacity to climate change, which is defined as the ability to adjust behaviors and expand coping strategies under climate variability [7]. While CBA is a recognized approach to enhancing adaptive capacity, gender remains under-represented within the realm of climate change adaptation [8].

The potentiality of CBA in mitigating climate-related health effects has been explored in the literature [9], as has the gendered nature of climate-related health outcomes [3]. Equally, literature has addressed the value of integrating gender into CBA [8]. However, climate change, CBA, health and gender have not been explored as a single nexus in a low-income context. Given the potentiality of CBA, and the detrimental gendered health effects of climate change in low-income settings, these concepts must be explored in conjunction.

This paper aims to address this literature gap by conducting a case study on the Adaptation Learning Programme (ALP) - a gender-integrated CBA program implemented in low-income, climate-vulnerable communities in Garissa County in Kenya. The case provides an ideal context for addressing the literary gap, as women in Garissa experience profound and unequal climate-related health consequences [10]. The climate change-CBA-health-gender nexus is explored by analyzing if and how the program's integration of gender enhanced women's adaptive capacity influences climate-related health impacts.

1.1. Introduction to the ALP

The Adaptation Learning Program was a 5-year CBA program implemented in 2010 by "CARE International" in six climate-

* Corresponding author.

E-mail address: d.montag@qmul.ac.uk (D. Montag).

§ 0000-0003-1365-1913

vulnerable communities in Garissa County [11]. The ALP aimed to enhance communities' adaptive capacity to climate change through CBA, using an approach informed by Africa Climate Change Resilience Alliance's (ACCRA) framework, which highlights five components of adaptive capacity; innovating with confidence, being involved in forward-looking decision-making, having access to assets, institutions and entitlements, and climate knowledge and information [7]. The ALP aimed to enhance women's adaptive capacity to climate change by implementing gender-sensitive CBA strategies, which will be explored in this paper [12].

1.2. The climate and health context of Garissa County

Garissa County is located in north-eastern Kenya, and consists of arid and semi-arid lands with scarce water sources [13]. Recently, Garissa has experienced more severe flooding and droughts as a result of climate change [14]. Consequently, rates of malnutrition have increased, as communities rely heavily on climate-sensitive livelihood strategies such as crop production and livestock rearing [12]. Climate variability has also contributed to an increase in vector-borne diseases such as malaria and Rift Valley fever [10].

1.3. Conceptualizing climate change, community-based adaptation and health in Garissa

CBA's potential in mitigating the localized nature of climate change-related health risks lies in its ability to engage the local community in identifying context-specific health vulnerabilities, which depend on contextual biogeophysical, sociocultural and economic factors [15]. For example, CBA allows communities in Garissa to identify malnutrition as a climate-related health risk, which consequently guides adaptation strategies [13]. Moreover, CBA integrates local value systems into the adaptation process, which enhances confidence, and empowers individuals to make informed health-protective decisions in a changing climate [16].

Despite this evidence, the positive health outcomes associated with CBA have received little academic attention [9]. Thus, the potentiality of CBA in protecting human health should be urgently supported.

1.4. Conceptualizing the gendered health effects of climate change and women's barriers to adaptive capacity in Garissa

The health impacts of climate change are unequally detrimental to women, especially in rural sub-Saharan Africa (SSA) communities, where women rely heavily on natural systems for livelihood generation [17]. In Garissa, social norms assign women the responsibility of water collection [10]. Due to increasingly intense droughts and water deprivation, women must walk significantly longer distances to collect water, which exposes them to exhaustion and early spine damage [2,18]. Moreover, gendered food hierarchies dictate that women in Garissa should decrease their meal intake to prioritise men's nutritional requirements [19]. This makes women more prone to nutritional deficiencies during climate-induced food shortages [20]. Kariuki et al. [21] also emphasize the role of gender relations when it comes to goat and sheep breeding in relation to stock and productivity in Garissa and other Kenyan regions. Women in Garissa are ascribed with nutritional responsibilities, and therefore, climate-related food insecurities signify women's failure to maintain livelihoods. This often leads to domestic violence against women [22]. Furthermore, while facing a climate-related increase in vector-borne diseases in Garissa, women are twice as likely to contract malaria in pregnancy, which increases the risk of spontaneous abortions and low birthweight [10,18].

A recent analysis by Haret et al. [39] evaluates the "impact of country climate change fund on community resilience to climate

change in Garissa", which had been introduced in 2018. The authors emphasise a need for a participatory approach to adaptation interventions, but do not address gender as a factor in their evaluation. However, in Garissa, women face multiple sociocultural and economic barriers to enhancing their adaptive capacity [12,23]. Firstly, women have unequal access to and control over assets, such as tractors. This limits their capacity to adapt to climate-related crop failures [22,24]. Moreover, cultural beliefs dictate that women should be excluded from most areas of decision-making [10]. This impedes women from voicing their health vulnerabilities and adaptive needs in community meetings [25]. Gender norms, which assign women to household and childrearing responsibilities, create "time poverty", creating less time for women to contribute to decision-making processes and adaptation strategies such as climate-smart agriculture [3,26,27]. Similarly, women's restricted social mobility impedes them from accessing markets to expand their economic opportunities away from climate-sensitive strategies [22]. Moreover, women in Garissa have limited access to reproductive healthcare services and education, and are disproportionately illiterate. Resultantly, they face restricted access to information and technology relevant to health and climate adaptation, such as written weather information [10,22]. Thus, women become disempowered and their health autonomy becomes impeded [28].

1.5. Conceptualizing gender-mainstreaming into CBA

Gender-mainstreaming assesses the implications for women and men of any planned action, which ensures that gendered determinants of health, such as power relations and livelihood strategies, are not excluded from CBA [18,25]. This legitimizes women's voices, for example, by involving them in decision-making processes, and allowing women to voice gender-specific health needs that must be incorporated into adaptation strategies [29]. This is vital in the CBA process, as climate-related health vulnerabilities are specific to women's sociocultural contexts [20]. CBA could, for example, enable women in Garissa to voice their disproportionate risk of nutrient deficiency, which could be addressed by training women in climate-resilient farming [20].

To date, many CBA processes have failed to address the social contexts that create gendered climate vulnerabilities [29]. Therefore, acknowledging CBA's use in addressing gendered climate-related health impacts is an urgent public health need.

2.0. Methods

The paper uses a single case study design. Single case studies are useful when researching a phenomenon in a unique environment [30]. This approach is appropriate, since the gendered health impacts of climate change are unique to the geophysical and socioeconomic context of Garissa. Equally, the concept of CBA is grounded in the concept of context-specificity [6], thereby justifying the use of a single case study.

This paper takes an interpretivist epistemological stance to the research problem, which assumes that social reality is produced and reproduced through the actions and interactions of people, and that any social truth is interpreted rather than objectively known [31]. The interpretivist perspective enables the authors to explore the complexity underlying the unique context of a phenomenon [32]. The case study methodology fits the epistemology of the paper, as it embraces an interpretivist theoretical orientation, which is applied to the Adaptation Learning Programme [30,33].

The chosen case is the Adaptation Learning Programme in Garissa County, from 2010 to 2015. Only the five years of implementation were analysed due to a lack of publications related to the ALP's long-lasting impacts. To address the research question, the authors investigated how gender was integrated into ALP's four CBA interventions

implemented in Garissa. The way in which gender integration enhanced women's adaptive capacity to the health effects of climate change was then analysed. The four CBA interventions, implemented by the ALP, are outlined below:

2.1 Community vulnerability and capacity analysis (CVCA)

The CVCA enabled communities to inform local adaptation needs through community meetings [22]. This allowed for traditional knowledge to be incorporated into adaptation planning, thereby providing an evidence base for tailoring adaptation strategies to the community's context-specific climate vulnerabilities [13].

2.2. Income-generating strategies

Income-generating strategies consisted of "Business Skills Development" (BSD) and "Village Savings and Loans Associations" (VSLA). Through community meetings, women in Garissa identified that a lack of business skills was a major gap to generating income through less climate-sensitive strategies. Diversifying away from pastoralism, a livelihood strategy under severe climate threat, aimed to increase women's asset base and enable women to take more financial risks. It furthermore aimed to enable more flexible investment decisions, using climate forecasts and information [34]. BSD taught individuals about market dynamics to enhance their market access. Moreover, it connected people to sources of government funding to aid funding proposals submissions [34]. The VSLA organized self-selected groups to finance small loans into shared accounts. This aimed to enhance financial security and enable the diversification away from climate-sensitive livelihoods strategies [34].

2.3. Participatory scenario planning (PSP)

The PSP promoted access to effective dissemination and interpretation of climate information at the community level by enabling dialogue between community actors and other stakeholders. This was aimed at making climate information relevant to various adaptive needs [35].

2.4. Adaptive agricultural practices

Adaptive agricultural practices consisted of "Climate Field Schools" (CFS), "conservation agriculture", "dryland livestock" and "improved seeds". The overarching goal was to enhance livelihood security by making crop production and livestock rearing more resistant to extreme weather [12].

2.5. Data collection

Data were collected from ALP publications. Given the absence of peer-reviewed publications, data were retrieved from grey literature only. The list of ALP publications was retrieved from two sources; ALP's official outcome report¹ and CARE's official website², in which a search filter was used.

To ensure the collection of relevant data, inclusion and exclusion criteria were formulated (see Annex 1). The inclusion and exclusion criteria with their justification were formulated for 8 criteria, encompassing: Criteria #1: ALP; Criteria #2: Gender; Criteria #3: CBA interventions; Criteria #4: Document type; Criteria #5: Timeframe; Criteria #6: Location; Criteria #7: Language; Criteria #8: Availability. The exclusion process, as guided by these criteria, is demonstrated in

the flowchart in Fig. 2. Through this process, six relevant ALP publications were retrieved for generating the results.

2.6. Data analysis

The data were analyzed systematically (Fig. 3). The following subsection details and justifies the process of data analysis using this table.

The paper investigates how each of the four CBA strategies implemented by the ALP in Garissa integrated gender to enhance women's adaptive capacity to the health impacts of climate change. Each table analyses one CBA strategy, creating a total of four results tables (demonstrated in Annexes 2-5). The horizontal row of the table represents women's adaptive capacity to climate change, which is the primary outcome being studied. To systematically analyse this outcome, ACCRA's five components of adaptive capacity are used, which are represented as five separate columns in the horizontal row.

The vertical column includes three different approaches to measuring the outcomes of the CBA interventions. The first row of the vertical column analyses *how* gender is integrated into each *intervention design* to promote each component of adaptive capacity. To illustrate, *how* did the CVCA attempt to enhance women's opportunity to participate in decision-making? The second row of the vertical column represents the primary, secondary and tertiary outcomes of the CBA interventions. Again, the primary outcomes represent ACCRA's five components of adaptive capacity. For example, the primary outcome of the CVCA is whether it enhanced women's opportunity to participate in decision-making. Secondary and tertiary outcomes were added to illustrate the "knock-on" effects of the primary outcomes, such as, what is the secondary outcome associated with enhancing women's opportunity to participate in decision making? And, what is the tertiary outcome associated with this secondary outcome? Secondary and tertiary outcomes aim to illustrate the process by which enhancing women's adaptive capacity in turn affected women's health outcomes. The last row of the vertical column represents the negative or unintended consequences of enhancing women's adaptive capacity.

3.0. Results

The results were generated using the six ALP publications identified in the flow chart in Fig. 2. The outcomes of the four CBA interventions were analysed using the data analysis table in Fig. 3, thereby generating four tables of results (displayed in Annexes 2-5). A conceptual framework was created to display and visualize the results (Fig. 4).

3.1. Introducing the conceptual framework of results

The conceptual framework visualizes the mechanisms through which the ALP's four CBA interventions enhance women's adaptive capacity to climate change (the primary outcomes), and the resultant outcomes of these mechanisms (the secondary, tertiary, and negative/unintended outcomes). The primary outcomes (displayed in the yellow box) represent ACCRA's five components of adaptive capacity. The mechanisms by which the CBA interventions enhance each adaptive capacity component are displayed in coloured arrows (which are explained in the key). The secondary and tertiary outcomes, visualised in the green and red boxes respectively, illustrate the "knock-on" effects of the primary outcomes. They illuminate the outcomes associated with enhancing women's adaptive capacity, including health-related outcomes. The framework's blue tier illustrates the negative and unintended outcomes.

¹ "Adaptation Learning Programme for Africa. ALP Results, Outcomes and Impacts Report. January 2010 to June 2015" (Percy et al., [12])

² careclimatechange.org

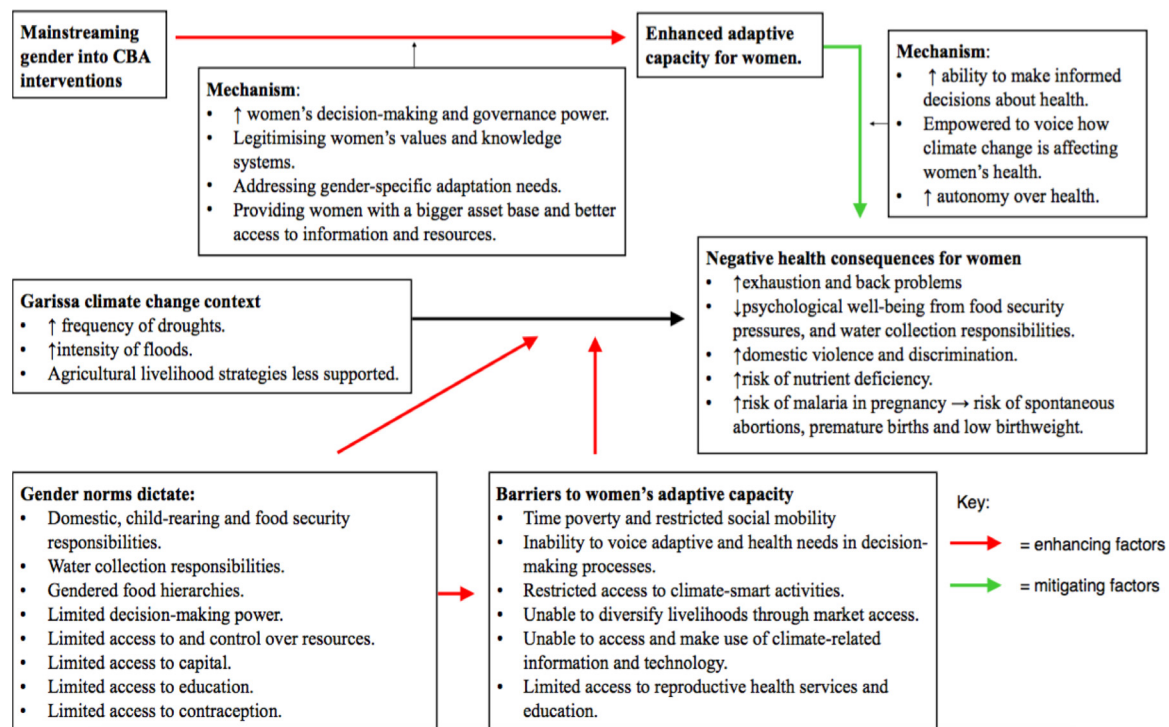


Fig. 1. Interaction between climate change, CBA, health and gender in Garissa County.

3.2. Primary outcomes

The subsequent paragraphs will systematically address each of ACCRA's five components of adaptive capacity, and outline how the CBA interventions achieved each component.

The first component of adaptive capacity, according to ACCRA, is empowering individuals to be innovative [36]. By allowing women to access markets, the BSD and VSLA empowered women to be innovative with less climate-sensitive livelihood strategies such as selling milk and honey. Moreover, the VSLA increased women's access to loans, which enabled them to start innovative businesses to sell non-perishable goods [12,34]. These processes are demonstrated by the red arrow pathway on the conceptual framework.

The second component of adaptive capacity is enhancing access to and control over assets [36]. This was achieved by the BSD and the VSLA (visualized by the red arrow pathways on the conceptual framework), which trained women in business skills, and thus enhanced their financial assets [34]. Moreover, adaptive agricultural strategies enhanced women's access to critical livelihood resources such as land, and livestock. Women were also able to generate a bigger agricultural asset base by adopting climate-resistant agricultural measures [22,37]. These mechanisms are displayed by the green arrow pathways on the conceptual framework. Despite women increasing their asset base through the ALP, men still remained largely in control over agriculture and finances [12,22].

The third component of adaptive capacity is the connection to institutions and entitlements [36]. This was achieved by the PSP, BSD and VSLA. The PSP created dialogue between women and stakeholders from the meteorological sector, to scale up women's climate-related adaptive priorities, and promote gender-sensitive designing of adaptation strategies [22]. The BSD and VSLA linked women to national banks to operate accounts and access loans, and connected women with government funding sources to enhance financial security [34].

The fourth component of adaptive capacity consists of enhancing access to climate-related knowledge and information [36]. The Climate Field Schools informed women on adapting their agricultural

livelihood practices to unfavourable climatic conditions, though which, women received resources in the form of tools, seeds and lessons about crop diversification [12,37]. Moreover, the PSP developed an approach which made climate information more relevant and equally accessible for both genders (as displayed by the yellow arrow pathway on the conceptual framework). Through this, women used climate information to inform adaptation approaches which were relevant to their livelihood strategies [34,37].

The fifth component of adaptive capacity consists of enhancing individuals' decision-making power and governance [36]. The PSP achieved this by engaging women in collective scenario planning for extreme weather events. Moreover, the CVCA empowered women to voice how climate was impacting their health and livelihoods, which pushed for adaptation strategies to become more gender-sensitive [11,12,37]. This is represented by the blue arrow pathways on the framework.

3.3. Secondary outcomes

The secondary outcomes display the changes in women's lives, and in the dynamics between men and women, which resulted as a "knock-on effect" of women acquiring greater adaptive capacity through the ALP's CBA interventions.

As demonstrated on the conceptual framework, each component of adaptive capacity led to women being empowered and feeling confident [11,12,22,37]. For example, as active members of decision-making processes, women became empowered to become active members of change [12]. Moreover, having access to climate information, market resources, and high-level institutions such as banks enabled women to have greater control over their livelihoods [11,12,37]. Consequently, men and women collaborated more, and women gained more respect from the community as agents of change [12].

By increasing women's access to climate information, institutional structures, and access to financial assets through markets and loans, women achieved greater financial and food security [12,34,37]. For example, access to climate-smart agriculture and climate information

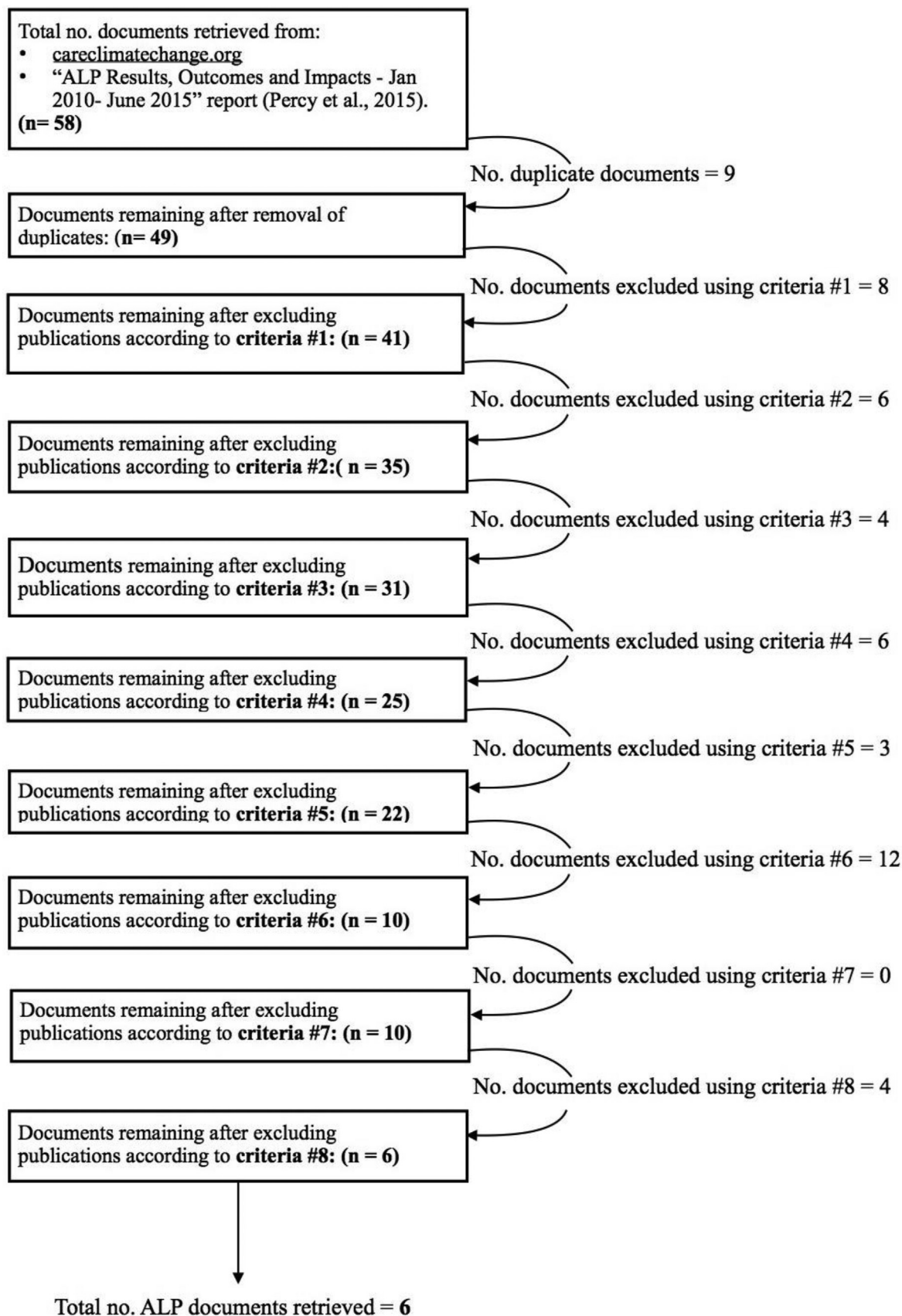


Fig. 2. Data Collection Flow Chart.

	Component of adaptive capacity				
	Opportunity to participate in decision-making and governance	Access to knowledge and information	Access to institutions and entitlements	Access to and control over assets	Empowerment to be innovative
How is gender integrated into the intervention design?	How did the intervention attempt to enhance women's opportunity to participate in decision-making?	How did the intervention attempt to provide better access for women to knowledge and information?	How did the intervention attempt to give women better opportunities to access institutions and entitlements?	How did the intervention attempt to provide women with access to and control over assets?	How did the intervention attempt to empower women to be innovative?
Outcomes: primary, secondary and tertiary	Primary outcome: Did the intervention enhance women's opportunity to participate in decision-making? Secondary outcomes: What were the results of the primary outcomes? Tertiary outcomes: What were the results of the secondary outcomes?	Primary outcome: Did the intervention provide women with better access to knowledge and information? Secondary outcomes: What were the results of the primary outcomes? Tertiary outcomes: What were the results of the secondary outcomes?	Primary outcome: Did the intervention give women better access institutions and entitlements? Secondary outcomes: What were the results of the primary outcomes? Tertiary outcomes: What were the results of the secondary outcomes?	Primary outcome: Did the intervention provide women with access to and control over assets? Secondary outcomes: What were the results of the primary outcomes? Tertiary outcomes: What were the results of the secondary outcomes?	Primary outcome: Did the intervention empower women to be innovative? Secondary outcomes: What were the results of the primary outcomes? Tertiary outcomes: What were the results of the secondary outcomes?
Negative/unintended outcomes	Were there negative/unintended outcomes associated with increasing women's participation in decision-making through this intervention?	Were there negative/unintended outcomes associated with providing women with better access to information and knowledge through this intervention?	Were there negative/unintended outcomes associated with increasing women's access to institutions and entitlements through this intervention?	Were there negative/unintended outcomes associated with providing women with access and control over assets through this intervention?	Were there negative/unintended outcomes associated with empowering women to be innovative through this intervention?

Fig. 3. Data Analysis Table.

enabled women to obtain better crop yields under harsh weather conditions [12,34]. Moreover, through improved business skills and market access, women were able to sell more products, such as milk and fruit juice. This allowed women to diversify away from climate-sensitive agricultural livelihoods [34].

3.4. Tertiary outcomes

The following tertiary outcomes represent the “knock-on” effects of the secondary outcomes outlined above. Through the tertiary outcomes, the impacts of the CBA interventions on women's health are illuminated.

By generating a greater income through market strategies, and by enhancing food security through adaptive agricultural practices and market participation, women had greater capacity to pay for health-care fees and to support healthcare needs [37]. Greater financial and

livelihood security equally gave households greater capacity to send children to school [37].

Moreover, by increasing food security, women experienced less physical and psychological pressure to turn available resources into a meal. Resultantly, men had greater respect for women as important contributors to livelihoods, which consequently reduced domestic violence against women [11]. This also resulted in a shift in gender roles, in which men became increasingly involved with domestic chores, which decreased the physical strain of large workloads for women [12,37].

3.5. Negative and unintended outcomes

This section highlights the unintended consequences of the ALP's CBA interventions, which resulted in adverse health outcomes for

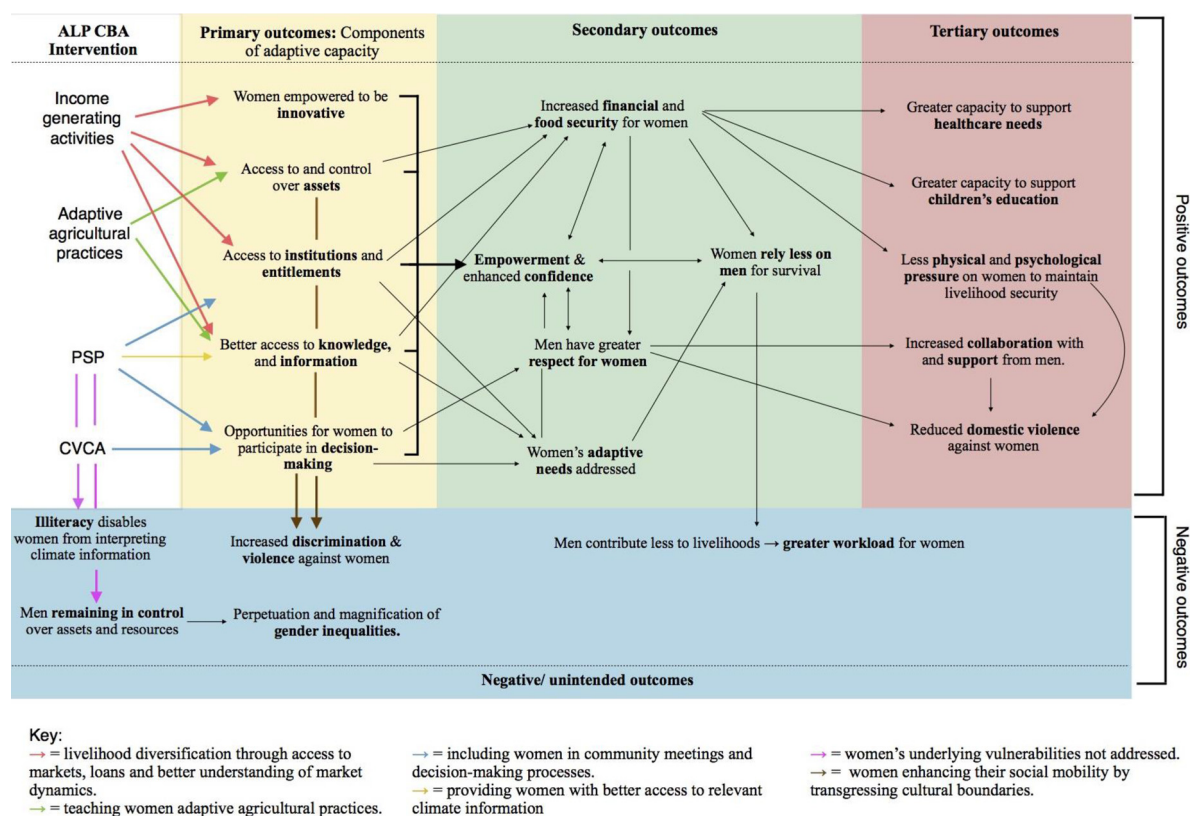


Fig. 4. Conceptual Framework Demonstrating the Outcomes of the ALP's CBA Interventions.

women. Further, it demonstrates the underlying causes of climate change vulnerability that the ALP failed to address.

The ALP's CBA interventions brought about several unintended outcomes for women. Firstly, increasing women's financial security and asset base through income-generating strategies created an incentive for husbands to contribute less to livelihoods, which in some cases increased women's workloads and physical exhaustion [22]. Secondly, through participating in CBA interventions, women transgressed patriarchal boundaries by mixing with the opposite sex in trade markets and community meetings. By violating cultural norms, some women faced discrimination and domestic violence [22]. This mechanism is illustrated by the brown arrows on the conceptual framework.

Moreover, the CBA interventions failed to address several of the underlying causes of women's vulnerability to climate change (demonstrated by the purple arrows on the conceptual framework). Firstly, illiteracy, which prevents most women in Garissa from understanding climate-related information in written form, was not addressed by the CBA interventions [12,22,37]. Moreover, women's reproductive healthcare needs were not integrated into the ALP. In fact, none of the CBA interventions focused on mitigating climate-related health risks for women and men alike. Although several tertiary outcomes represent health-related outcomes, the mitigation of health risks was not an explicit goal of the ALP and was not systematically integrated into the program [11,12,22,34,37].

4.0. Discussion

4.1. Addressing restricted social mobility and time poverty

The ALP enhanced women's social mobility by increasing their market access through the BSD and VLSA [34], and integrating women into decision-making processes through the CVCA and PSP [11,37]. BSD and VLSA allowed women to increase their financial and

food security, thereby generating greater financial and time capacity to address healthcare needs. It also caused less pressure on women to maintain livelihood security, and decreased their time poverty [22]. Reducing time—poverty and increasing social mobility enables women to participate in community meetings, in which they can voice their health vulnerabilities to climate change [22,26]. Firstly, this allows for women's adaptive needs to be addressed [16,28]. Secondly, it empowers women to make informed decisions to protect their health [15,16].

While CBA engagement increased women's social mobility to an extent, the ALP did not address women who cannot leave the house unaccompanied by men [11,12,22,34,35,37]. The ALP thereby failed to address the underlying gendered structures which restrict women's social mobility. Restricted social mobility limits women's adaptive capacity in many low-income settings globally, and CBA interventions in other contexts have demonstrated how this barrier can be addressed. For example, through a United Nations Development Programme (UNDP)-led CBA program in Morocco, women held community meetings in their homes because they were not allowed to participate in public meetings. This allowed women to meet without restrictions, and empowered them to find shared solutions on enhancing their adaptive capacity [3].

4.2. Addressing women's restricted ability to diversify away from climate-sensitive livelihoods

Women's restricted ability to diversify away from climate-sensitive livelihood strategies results from gendered labor divisions which dictate women's dependence on natural systems for livelihood generation [17,27]. The BSD and VLSA addressed this barrier by increasing women's financial capital. Moreover, climate-smart agricultural activities taught women adaptive agricultural practices, thereby enhancing their food security [12,37], which is vital for women who risk nutrient deficiency due to gendered food hierarchies [18,19,20].

Furthermore, restructuring gendered labor divisions by engaging women with the “masculine” economic sector consequently incentivizes men to take up “feminine” labor tasks, which can protect women’s health. This was illustrated in a CBA program in Cambodia, where men taking up “feminine” tasks protected women from physical exhaustion related to feminized labor [8].

The importance of income-generating strategies is recognized on a governmental level in Kenya. According to Kenya’s 2015–2030 National Adaptation Plan, enhancing women’s economic resilience is key to developing adaptive capacity to climate change. The report recognizes that women face barriers to adaptive capacity largely because of an inequitable gendered labor force, and restricted access to capital and credit. The ongoing governmental initiative “Youth and Women Enterprise Fund” aims to provide accessible and affordable credit to support women with starting or expanding business opportunities and creating employment, in order to enhance climate resilience [14].

The ALP’s CBA interventions did not, however, address gendered water collection roles [22]. It thereby failed to address women’s risk of exhaustion and spine damage, which result from long walking distances associated with climate-induced water scarcity [2,18].

4.3. Addressing women’s restricted decision-making power

Through the PSP and CVCA, the ALP enhanced women’s decision-making power [12], which empowered women to become active agents of change. This resulted in improved working relationships between men and women, which consequently lowered domestic violence against women [22]. Moreover, enhancing community members’ voice in decision-making processes empowers individuals to voice climate-related health vulnerabilities [3,15,28]. This is demonstrated by a CBA intervention in Northern Canada, which engaged should aboriginal communities react Indigenous Peoples? such as limited sea ice access resulting in food insecurities. It informed the design of adaptation policies such as education programs on how to minimize food insecurity, thereby allowing communities to make informed decisions regarding their health [28]. This illustrates that if women’s health needs are voiced in decision-making processes and addressed through adaptation strategies, it enables women to gain health autonomy in a changing climate [15,16,28].

While literature and case examples show that addressing health vulnerabilities through decision-making processes can mitigate climate-related health risks, it is worth noting that the mitigation of health risks was not an integral goal of the ALP. Therefore, ALP publications do not specify whether women’s decision-making power allowed them to voice their health concerns in community meetings, and whether these were addressed at all. Finally, this made women’s climate-related health outcomes difficult to analyze.

4.4. Addressing women’s limited access to climate-related information and technology

Lack of access to climate-related information and technology in Garissa is guided by norms which distribute less control over resources to women [22]. The PSP addressed this barrier by disseminating gender-sensitive climate information [37]. Having better access to these resources empowered women, and increased their financial and food security, consequently increasing their capacity to address healthcare needs [37]. Moreover, it reduced levels of domestic violence, as women became more respected by men as important livelihood contributors [12].

Despite the success of the PSP, illiteracy impeded many women from interpreting climate information in written form [22]. Moreover, men remained in control of information dissemination tools such as phones and radios [12]. Thus, due to unequal power distributions, the PSP benefited men more than women [22]. This

contextualizes a scenario in which CBA interventions risk perpetuating gender inequalities, by reaffirming the structures that give men more control over assets [6].

4.5. Addressing women’s restricted access to reproductive healthcare services

Enhancing the access to reproductive healthcare was not integrated into the ALP’s interventions, thereby failing to address pregnant women’s climate-related susceptibility to malaria [18]. This affirms the need to integrate primary healthcare into CBA, given the sector’s expertise on protecting local populations from climate-related health risks such as vector-borne diseases [9,16]. Haines et al. [38] note that CBA programs are an effective way to deliver critical primary healthcare services at the local level. This is illuminated by the UNDP/World Health Organization (WHO) CBA project in Bhutan, in which strong engagement from the health ministry successfully enhanced communities’ protection from climate-related health risks [9]. Furthermore, by not enhancing women’s access to contraceptives, the ALP did not address childrearing responsibility and time poverty as an adaptive barrier and underlying structural vulnerability to climate change [22].

4.6. Addressing the negative and unintended consequences of the ALP

The unintended consequences of the CBA interventions in some cases resulted in men contributing less to livelihoods, perpetuated workloads for women, and domestic violence faced by some women who transgressed cultural boundaries [22]. This illuminates that CBA should not be viewed within a faultless narrative and that CBA interventions must be sensitive to the sociocultural contexts of communities, and to the complex structures that shape women’s social identities [6,8].

4.7. Global implications of the case study: applying lessons learned to other contexts

While this case study explores women’s adaptive capacity, and the outcomes of a CBA programme in a highly specific context, lessons learned from in-depth studies on CBA programs can identify patterns which can be applied to other contexts [8]. For example, the adaptive barriers faced by women in Garissa apply to women in many other low-income settings [3]. A UNDP-led CBA program implemented in 10 low-income countries,³ found that like in Garissa, women’s adaptive capacity is restricted by limited social mobility and decision-making power, time in poverty, the reliance on natural systems for livelihood generation, and limited access to education and healthcare [3]. While this does not imply that women globally face identical climate-related health risks, the adaptive barriers shared by women in multiple contexts implies that this analysis of the ALP may inform the questions that shape the implementation of future CBA programs, to protect women’s health in other contexts [8].

4.8. Scaling up findings from the case study

Bottom-up approaches to adaptation generate meaningful understandings that can be scaled up to inform national policies on gender-sensitive climate change adaptation [8]. Scaling up this case study’s findings can inform national-level stakeholders in Kenya of the need to effectively disseminate primary healthcare and educational opportunities for women at the local level. Up-scaling of locally-identified vulnerabilities are vital, because they require top-

³ Bangladesh, Bolivia, Guatemala, Jamaica, Kazakhstan, Morocco, Namibia, Niger, Samoa and Vietnam

down input from stakeholders with political power to be effectively addressed [28].

4.9. Limitations of the analysis

The authors acknowledge that the ALP conducted a gender analysis in Garissa, which is publicly inaccessible [11,12,37]. A gender analysis explores the relationships between men and women, their control over resources, and their roles in the community and household [18]. Without access to Garissa's gender analysis, the ALP's integration of social structures that shape women's health vulnerabilities could not be assessed with maximum validity. The lack of accessible ALP follow-up reports, meant that programme's lasting impacts could not be assessed.

5.0. Conclusion

This case study situates the climate change-CBA-gender-health nexus in the context of Garissa, showing that to successfully enhance women's adaptive capacity to the climate-related health impacts, CBA interventions must integrate access to education and reproductive healthcare, and address women's restricted social mobility. This finding can frame questions for the future implementation of gender-sensitive CBA strategies in other low-income settings.

The conceptual framework demonstrates how the ALP's CBA led to both positive and negative health outcomes through enhancing women's adaptive capacity to climate change. This framework provides internal value for future research, as it can be used to systematically structure case study findings, which explore the climate change-CBA-health-gender nexus in other contexts. Equally, the literature review framework enables the systematic analysis of CBA programs in settings which share similar climate and gender norm contexts with Garissa. Moreover, the contextual findings on the gendered implications of climate change adaptation from this case can be used to frame recommendations for health adaptation in other low-income contexts, in which gender norms influence adaptive capacity.

Author agreement

We confirm that the manuscript has been read and approved by all named authors.

Ethical approval

Ethical approval for this type of study is not required by our institute.

Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Appendix

Annex 1–5

References

- Costello A, Allen E. Managing the health effects of climate change. *Lancet North Am Ed* 2009;373(9676):1693–733.
- WHO. Gender, climate change and health. Geneva: World Health Organization; 2014.
- Vincent K, Wanjiru L, Aubry A, Mershon A, Nyandiga C, Cull T, et al. Gender, climate change and community-based adaptation. New York: United Nations Development Programme; 2010.
- Watts N, Adger N, Agnolucci P, Blackstock J, Byass P, Cai W, et al. Health and climate change: policy responses to protect public health. *Lancet North Am Ed* 2014;386(10006):1861–914.
- IPCC. Climate change 2007: impacts, adaptation, and vulnerability. Cambridge: Cambridge University Press; 2007.
- Ford J, Sherman M, Berrang-Ford L, Llanos A, Carcamo C, Harper S, et al. Preparing for the health impacts of climate change in indigenous communities: the role of community-based adaptation. *Glob Environ Chang* 2018; 49:129–39.
- Berger R, Ensor J, Wilson K, Phukan I, Dasgupta S. Adaptive capacity. in: *community-based adaptation to climate change. scaling it up*. New York: Routledge; 2014. p. 22–35.
- Jerneck A. Taking gender seriously in climate change adaptation and sustainability science research: views from feminist debates and sub-saharan small-scale agriculture. *Sustain Sci* 2018;13(2):403–16.
- Ebi KL, Barrio MOD. Lessons Learned on Health Adaptation to Climate Variability and Change: Experiences Across Low- and Middle-Income Countries. *Environ Health Perspect* 2017;125(6):1–7.
- Council of Governors. Garissa county government: county integrated development plan 2013–2017. Nairobi: Government of Kenya; 2017.
- Nottawasaga Institute. Adaptation learning programme (ALP) care international. mid-term review. final report. Nairobi: Nottawasaga Institute; 2012.
- Percy F, Ward N, Muecke P. Adaptation learning programme for africa: alp results, outcomes and impacts report. january 2010 to june 2015. Nairobi: CARE International; 2015.
- Dazé A. Climate change vulnerability and adaptive capacity: synthesis and lessons from ghana, kenya and niger. Nairobi: CARE International; 2015.
- Government of Kenya. Kenya national adaptation plan 2015–2030. Nairobi: Ministry of Environment and Natural Resources; 2016.
- Ebi KL. Facilitating climate justice through community-based adaptation in the health sector. *Environ Justice* 2009;2(4):191–5.
- Shumake-Guillemot J, Ebi K, Kabir I, Nguyen T, Malkawi M. Scaling up community-based adaptation to protect health from climate change. in: *community-based adaptation to climate change. scaling it up*. New York: Routledge; 2014. p. 155–71.
- Bryan E, Bernier Q, Espinal M, Ringler C. Making climate change adaptation programmes more gender responsive: insights from implementing organisations on the barriers and opportunities. *Clim Develop* 2017;10(5):417–31.
- Haddad Z, Prats EV. Mainstreaming gender in health adaptation to climate change programmes. Geneva: WHO; 2012.
- Goh A. A literature review of the gender-differentiated impacts of climate change on women and men's assets and well-being in developing countries, 106. IFPRI Publications; 2012.
- Bryan E, Behrman JA. Community-based adaptation: a theoretical framework, overview of key issues and discussion of gender differentiated priorities and participation. CAPRI 2013;Volume 109:1–31.
- Kariuki J, Galie A, Birner R, Chagunda M, Jakinda S, Mili D, et al. Does the gender of farmers matter for improving small ruminant productivity? A Kenyan case study. *Small Ruminant Res* 2022;206:106574.
- Webb J. Gender dynamics in a changing climate: how gender and adaptive capacity affect resilience. Nairobi: CARE International; 2015.
- Chepkoech W, Mungai N, Stöber S, Lotze-Campen H. Understanding adaptive capacity of smallholder African indigenous vegetable farmers to climate change in Kenya. *Clim Risk Manage* 2020;27:100204.
- Wanjiku J, Manyengo JU, Oluoch-Kosura W, Karugia JT. Gender differentiation in the analysis of alternative farm mechanization choices on small farms in Kenya. Food insecurity, vulnerability and human rights failure. London: Palgrave Macmillan; 2007. p. 94–218.
- Wright H, Chandani A. Gender in scaling up community-based adaptation to climate change. in: *community-based adaptation to climate change: scaling it up*. New York: Routledge; 2014. p. 226–38.
- Deering K. Gender-Transformative adaptation. Nairobi: CARE International; 2019.
- Ngigi M, Mueller U, Birner R. Gender differences in climate change adaptation strategies and participation in group-based approaches: an intra-household analysis from Rural Kenya. *Ecol Econ* 2017;138:99–108.
- Ebi KL, Semenza JC. Community-based adaptation to the health impacts of climate change. *Am J Prev Med* 2008;35(5):501–7.
- Otzelberger A, Ward N. Understanding gender in community based adaptation. Nairobi: CARE International; 2016.
- Yin RK. Case study research and applications: designs and methods. sixth edition. Los Angeles: SAGE Publications; 2018.
- Greenhalgh T, Russell J. Evidence-based policymaking: a critique. *Perspect Biol Med* 2009;52(2):304–18.
- Pham L. 2018. A Review of key paradigms: positivism, interpretivism and critical inquiry. [Online]. Available at: https://www.researchgate.net/publication/324486854_A_Review_of_key_paradigms_positivism_in_interpretivism_and_critical_inquiry [Accessed 06 May 2020].
- Baxter P, Jack S. Qualitative case study methodology: study design and implementation for novice researchers. *The Qual Report* 2008;13(4):544–59.
- Wagner R, Ward N, Percy F. ALP adaptation strategies compendium. Nairobi: CARE International; 2015.

- [35] Ambani M, Percy F. Decision-Making for climate resilient livelihoods and risk reduction: a participatory scenario planning approach. Nairobi: CARE International; 2012.
- [36] Jones L, Ludi E, Levine S. Towards a characterisation of adaptive capacity: a framework for analysing adaptive capacity at the local level. London: ODI; 2010.
- [37] Nottawasaga Institute. Adaptation learning programme (ALP) final evaluation report. Nairobi: Nottawasaga Institute; 2015.
- [38] Haines A, Sanders D, Lehmann U, Rowe A, Lawn J, Jan S, et al. Achieving child survival goals: potential contribution of community health workers. *Lancet North Am Ed* 2007;369(9579):2121–31.
- [39] Haret A, Huho J, Mohamed A, Golicha H. Evaluation of the impact of county climate change fund on community resilience to climate change in Garissa county, Kenya. *American J Clim Stud* 2021;2(1):38–59.

Annex 1

Inclusion and exclusion criteria.

Criteria type	Inclusion criteria	Exclusion criteria	Justification
Criteria #1: ALP.	Must be directly linked to the Adaptation Learning Programme (ALP).	Any publication that is not directly linked to the Adaptation Learning Programme (ALP).	CARE has several publications within the field of gender and CBA, which are not directly linked to the ALP.
Criteria #2: Gender.	Must contain gender-focused sections.	Any publications which do not include gender-focused sections.	The gender/CBA discourse is at the center of the case study.
Criteria #3: CBA interventions.	Must include the four CBA interventions used in Garissa.	Any publications which do not include gender-focused sections.	The case study attempts to answer the research question by analysing how gender was integrated into ALP's four CBA interventions in Garissa County.
Criteria #4: Document type.	Anything other than practitioner briefs.	Practitioner Briefs.	Given that primary research was not undertaken, practitioner briefs were not deemed relevant.
Criteria #5: Timeframe.	Publications related to the ALP's initial years of implementation (2010–2015).	Publications on the ALP extension programme (2015–2017).	The extension programme was implemented in Embu County in Kenya and was therefore excluded from the case study.
Criteria #6: Location.	Garissa County, Kenya.	Any location other than Garissa County, Kenya.	ALP works in four countries: Ghana, Kenya, Mozambique and Niger. This case study focuses on the ALP work carried out in Garissa in Kenya.
Criteria #7: Language.	English.	Non-English.	Unable to interpret findings in languages other than English.
Criteria #8: Availability.	Published reports.	Unpublished reports.	The authors was unable to access data that was not published.

Annex 2

Table Showing Results for the CVCA Intervention.

	Component of adaptive capacity				
	Opportunity to participate in decision-making and governance	Access to knowledge and information	Access to institutions and entitlements	Access to and control over assets	Empowerment to be innovative
Design	Sources: [11,37] Aimed to: • Ensure men and women's equal participation in decision-making. Allow women to raise points about gender-specific adaptation needs.				
Outcomes: primary, secondary and tertiary	Sources: [11,12,37] Primary outcome: Enhanced women's decision-making role by allowing women to voice which adaptation strategies should be prioritized to meet their adaptive needs. Secondary outcomes: Gender-sensitive adaptation strategies identified such as business skills training for women. Empowered women and increased their confidence by allowing them to contribute to decision-making processes.				
Negative/ unintended outcomes	Source: [22] • Women who participated in decision-making processes risked facing discrimination due to transgression of cultural boundaries.				

Annex 3

Table showing results for income generating activities: Business Skills Development (BSD) and Village Savings and Loans Association (VSLA) interventions.

	Component of adaptive capacity				
	Opportunity to participate in decision-making and governance	Access to knowledge and information	Access to institutions and entitlements	Access to and control over of assets	Empowerment to be innovative
Design		Source: [34] Designed to increase women's access to: <ul style="list-style-type: none">• Information on market dynamics.• Information on loan applications.	Source: [34] Designed to: <ul style="list-style-type: none">• Connect women to sources of government funding.• Link women to national banks to open and operate accounts.	Source: [34] Designed to: <ul style="list-style-type: none">• Diversify women's livelihood strategies by increasing their market access, and thus to provide greater access to and control over assets.	Source: [34]Designed to: <ul style="list-style-type: none">• Empower women to be innovative by allowing them to diversify away from climate-sensitive livelihood strategies by increasing their access to markets and loans.
Outcomes: primary, secondary and tertiary	Sources: [12,34] Primary outcomes ↑ women's access to financial resources. Provided women with information on loan applications. Secondary outcomes ↑social protection in face of new/unexpected risks. ↑ women's confidence ↑food and financial security ↓reliance on men for generating an asset base. Tertiary outcomes ↑money spent on children's education. ↑financial capacity to address healthcare needs. ↓levels of domestic violence as women were under pressure to maintain livelihoods.	Source: [34] Primary outcomes Women were connected with organisational structures which enabled them to write funding proposals to the UNDP. More women were linked to national banks. Secondary outcomes ↑ financial security and social protection in face of unexpected risks. ↑ women's confidence to engage directly with markets. <ul style="list-style-type: none">• ↑ food security.• ↓reliance on men for generating an asset base. Tertiary outcomes <ul style="list-style-type: none">• ↑money spent on children's education.• ↑financial capacity to address healthcare needs.• ↓levels of domestic violence as women were under pressure to maintain livelihoods.	Sources: [12,34] Primary outcomes Women increased their asset base and diversified livelihoods by becoming more financially independent. Women increased their profits from existing practices such as milk and honey sales.Women's groups in Ninighi started small-scale fruit juice and milk businesses. This resulted a profit of US\$ 225 per month. <ul style="list-style-type: none">• Secondary outcomes ↓reliance on men for generating an asset base. ↑food security. ↑social protection in face of new/unexpected risks. Tertiary outcomes ↓levels of domestic violence as women were under pressure to maintain livelihoods. ↑financial capacity to address health-care needs.	Sources: [11,34,37] Primary outcomes <ul style="list-style-type: none">• ↑ women's confidence to be innovative with less climate-sensitive livelihood strategies. Secondary outcomes ↑ women's confidence and empowerment through ↑economic independenceMen had greater respect for women. ↑ women's confidence to speak at community meetings and to take part in decision-making. Tertiary outcomes <ul style="list-style-type: none">• ↓levels of domestic violence secondary to increased respect for women.• ↑collaboration between men and women. Men increasingly helped with water, fuel and wood collection, and child-care.	
Negative/ unintended outcomes	Source: [22] <ul style="list-style-type: none">• ↑ women's income resulted in men deciding to contribute less to household work. This resulted in a greater workload for women. access to asset base and livelihood resources did not lead to significant increase in control over resources.	Source: [22] <ul style="list-style-type: none">• ↑ women's income resulted in men deciding to contribute less to household work. This resulted in a greater workload for women.	Source: [22] <ul style="list-style-type: none">• ↑ women's income resulted in men deciding to contribute less to household work. This resulted in a greater workload for women.	Source: [22] Women who transgressed societal and cultural boundaries by mixing with the opposite sex in trade markets risked facing criticism, domestic violence, social stigma and discrimination. ↑ women's income resulted in men deciding to contribute less to household work. This resulted in a greater workload for women. ↑ women's asset base resulted in men migrating away in search for other new work. This led to female-headed households facing discrimination and having greater workloads.	

Annex 4

Table showing results for Participatory Scenario Planning (PSP) intervention.

	Component of adaptive capacity				
	Opportunity to participate in decision-making and governance	Access to knowledge and information	Access to institutions and entitlements	Access to and control over of assets	Empowerment to be innovative
Design	<p>Sources: [11,35] Designed to:</p> <ul style="list-style-type: none"> • ↑ women's decision-making power by engaging them in PSP meetings. This aimed to give women a bigger say in which adaptation strategies were relevant for them. 	<p>Sources: [22,35,37] Designed to:</p> <ul style="list-style-type: none"> • Make climate information equally accessible to men and women. • Make presentation formats and dissemination channels of climate information tailored to women's adaptive needs. • Make early warning systems more accessible to women. 	<p>Source: [22] Designed to:</p> <ul style="list-style-type: none"> • Create dialogue between women and local government as well as meteorological staff. 		
Outcomes: primary, secondary and tertiary	<p>Sources: [11,12,22,37]</p> <p>Primary outcomes Engaged women in collective scenario planning and decision-making.</p> <p>Secondary outcomes: Women's climate concerns and adaptive needs were addressed. ↑ women's confidence and empowerment through greater involvement in community leadership. Men gained respect for women as powerful drivers of change.</p> <p>Tertiary outcomes: ↑ collaboration between men and women.</p>	<p>Sources: [11,37] Primary outcomes Enhanced women's access to climate information. Early warning systems became more accessible to women.</p> <p>Secondary outcomes: Helped women acknowledge the existence of climate change despite religious doctrines stating that futuristic predictions of the weather are illegal. Women's adaptive needs were addressed.</p> <p>• Tertiary outcomes ↑ collaboration between men and women.</p>	<p>Source: [11,22]</p> <p>Primary outcomes ↑ access collaboration between meteorological institutions and women.</p> <p>Secondary outcomes Enhanced women's empowerment and confidence through increased connections to governmental structures, as their voices were being heard by people outside their community.</p>		
Negative/ unintended outcomes	<p>Source: [22]</p> <p>Women who participated in decision-making processes risked facing discrimination due to transgression of cultural boundaries.</p>	<p>Sources: [11,12,37]</p> <p>Low literacy levels amongst women was not adequately addressed. Climate information was often distributed in written form. Men remained in greater control over mobile phones and radios. This resulted in unequal control over resources, and thus risking magnification of gender inequalities.</p>			

Annex 5

Table showing results for Adaptive Agricultural Strategies interventions: Climate Field Schools (CFS), Conservation agriculture, Dryland livestock and Improved seeds.

	Component of adaptive capacity				
	Opportunity to participate in decision-making and governance	Access to knowledge and information	Access to institutions and entitlements	Access to and control over assets	Empowerment to be innovative
Design		Source: . [12] Designed to: <ul style="list-style-type: none"> CFSs were aimed to address learning needs in the field of agriculture. Most CFSs were led by women. 		Source: [22] Designed to: <ul style="list-style-type: none"> Enhance women's access to livelihood resources through agricultural training to promote diversification of economic opportunities. 	
Outcomes: Primary, secondary and tertiary		Sources: [12, 37] Primary outcomes Women received information and resources in the form of tools, seeds and learning visits to learn about crop diversification and efficient irrigation systems. Secondary outcomes ↑ food security Shift from nomadic way of life. Tertiary outcomes. <ul style="list-style-type: none"> Women under less pressure to turn livelihood resources into a meal. ↑ money spent on children's education. Less young children taken out of school. ↑ financial capacity to address healthcare needs.		Sources: : [12,22,37] Primary outcomes: Access to livelihood resources such as land, and involvement in livestock trade. Enable women to accumulate assets through improved agricultural practices. Secondary outcomes ↑ food security Shift from nomadic way of life. Tertiary outcomes. <ul style="list-style-type: none"> Women under less pressure to turn livelihood resources into a meal. ↑ money spent on children's education. Less young children taken out of school. ↑ financial capacity to address healthcare needs.	
Negative/ unintended outcomes		Source: [12] More men than women took part in the agricultural practices (except for CFS).			