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Landscape analysis of the Kenyan policy on the treatment and prevention of diarrheal disease among under-5 children

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ABSTRACT

Objective Diarrhoea remains a leading cause of morbidity and death among under-5 children in Kenya, despite multipronged policy and programme initiatives to increase access to treatment. This study interrogates the comprehensiveness and adequacy of Kenya's policies, frameworks and action plans for diarrheal management and prevention. The study seeks to identify policy and practice gaps that need to be filled to strengthen diarrhoea treatment and prevention among under-5 children in Kenya.

Design Our study is a landscape analysis, which seeks to identify the gaps in the current Kenya diarrheal policy, frameworks and action plans. The critical questions included their comprehensiveness, the availability of elaborate treatment, management and prevention solutions, together with updatedness, building on evidence from extant literature on key pathways to infection relating to man-animal environmental interaction, which are critical in enteric infection prevention initiatives.

Data sources We conducted an internet search of databases of Government of Kenya's Ministry of Health; relevant websites/publications of international organisations and groups (Centre for Disease Control and Prevention, UNICEF and WHO) and published and grey literature (Google searches, Google Scholar and PubMed).

Eligibility criteria Included are publicly available key national diarrheal policy frameworks, plans, strategies, laws, institutional frameworks and operational guidelines that inform pertinent questions on the adequacy of policy and practice and preventive policy updates and actions. Further, peer-reviewed and grey literature on diarrheal morbidity and mortality and diarrheal prevention and management are included. The analysis excluded any information that was not referenced on the internet nor obtained from the internet.

Data extraction and synthesis The review team extracted the key provisions of the policy guidelines guided by a checklist and questions around the adequacy of existing national policies in addressing the determinants, prevention and treatment interventions of enteric infections and diarrhoea among under-5 children in the country. The checklist covered Kenyan background and diarrhoea situation analysis, policy objectives, policy strategies and policy implementation.

Results The analysis identified a corpus of strategies for the management of diarrhoea at multiple levels: health facilities, communities and households. The policies highlighted advocacy, health communication and social mobilisation, as well as logistics management and prevention strategies. However, the triangulation of evidence from the policy provisions and extant literature identified critical policy gaps in diarrhoea prevention and management in Kenya, particularly the lack of focus on zoonotic pathways to enteric infection, environment-pathogen linkages and operationalisation of the roles of social determinants of health and related services. The policy documents had limited focus on rapid diagnosis, vaccine development and deployment, together with weak funding commitment towards implementation and unclear pathways to funding responsibilities.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Addressing specific questions on current Kenyan diarrheal policy gaps should aid in identifying priority areas, guiding effective policy updates and achieving the best policy options to accelerate under-5 health outcomes.
⇒ The landscape analysis approach provided a platform to ask simple and clear questions on the purpose and scope of the analysis, enabling the collection of appropriate data from critical sources.
⇒ The analysis formed a preparatory entry point into an ongoing larger cohort study on urban societal development and the ecology of enteric disease transmission among infants, domestic animals and the environment in urban Kenya and future initiatives in the region.
⇒ The landscape analysis did not offer an opportunity to enable an evaluation of where and how the policy options met the people and how such interactions gave rise to the stall in under-5 enteric morbidity and mortality decline in Kenya.
⇒ The findings of the study are foundational and not yet generalisable across low-income and middle-income countries; further studies and participatory engagement of stakeholders are logical ways forward.

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Conclusion Policies are central to guiding programmatic actions towards effective enteric and diarrhoea prevention and management measures in Kenya. This study shows the need for policy updates to reflect pathways to enteric infections not covered in the current policy guidelines. Further, there is a need to strengthen the treatment and management of infection through rapid diagnosis, vaccine development and deployment, and strong funding commitment towards implementation together with clear funding responsibilities. Together, these will be vital in strengthening the current policy provisions and addressing other pathways to the prevention of enteric infections relating to zoonotic, environment-pathogen linkages and social determinants of health in Kenya and other low-income and middle-income countries.

Trial registration number NCT05322655.

INTRODUCTION

Diarrhoea remains a leading cause of death in children worldwide. In 2017, it accounted for approximately 8% of all deaths among children under the age of 5, about 525 000 globally,[1 2] with most deaths among children living in South Asia and sub-Saharan Africa (SSA).[3] Diarrheal morbidity and mortality in children are caused by exposure to contaminated environmental fomites containing enteric pathogens, such as *Shigella spp*, pathogenic *Escherichia coli*, *Campylobacter spp*, rotavirus, adenovirus and *Cryptosporidium spp*.[4] Environmental pathways to enteric pathogen exposures in children include contact with animals and flies, consumption of contaminated foods and limited access to clean water, poor sanitation and hygienic (WASH) services.[5]

Policies and legislative frameworks formulated by governments in both high and low-income and middle-income economies to address the incidence of child morbidity and mortality from enteric infections are widely documented.[6–9] Following a series of research evidence, the WHO in 1978 launched the global diarrheal diseases control programme with oral rehydration salts (ORS) at its heart and the short-term objective of reducing mortality due to diarrhoea, and in 2004, UNICEF and the WHO recommended treating childhood diarrhoea by replacing lost fluids through ORS, continued feeding and zinc supplements.[10] A more recent guideline, the Integrated Global Action Plan for the Prevention and Control of Pneumonia and Diarrhoea, developed by WHO/UNICEF, provides an integrated framework of using and promoting key interventions such as exclusive breastfeeding of children <6 months, immunisation, treatment with ORS and WASH interventions.[11] Globally, the availability of these simple solutions has been linked to a 64% decrease in the annual number of deaths from diarrhoea among children under 5 between 2000 and 2018.[3] However, diarrhoea mortality remains high and the use of ORS and zinc is low, particularly among rural residents and poor households across regions in SSA.[3 12 13]

Building on WHO/UNICEF recommendations aimed at using a new ORS formulation containing lower concentrations of glucose and salt (low osmolarity ORS) and zinc sulphate in the management of diarrheal diseases,[10] Kenya's Ministry of Health formulated policy guidelines on control and management of diarrheal diseases in children below 5 years in 2010 and 2014.[13 14] The policy adopted several initiatives to increase access to diarrhoea treatment for children, including the national diarrhoea and pneumonia scale-up plan, reclassification of zinc sulphate from prescription-only to over-the-counter product, development of a locally produced ORS/zinc co-pack and the introduction of the rotavirus vaccine into the national routine immunisation schedule.[13]

Despite these efforts and recorded successes in diarrhoea management, the 2015 Kenya Demographic and Health Survey (KDHS) indicated that the national prevalence of under-5 diarrheal diseases remained at approximately 15%, a slight national decrease from 16.6% in 2010.[15] Prevalence was mostly high among children aged 6–11 months (27%) and 12–23 months (24%) and in Western, Nyanza, Coast and Nairobi regions (16%–20%).[15] The prevalence was highest among the lowest wealth quintile (17.2%) and decreased with increasing wealth quintile. In the latest released 2022 KDHS report, very little has changed with prevalence still at 14% among children under age 5, with advice or treatment sought for 58% and oral rehydration therapy (ORT) and supplemental zinc, combined with continued feeding, which are the recommended interventions, given simultaneously to 20% of children.[16]

The overall low progress in reducing the national and subgroup levels of prevalence of under-5 diarrheal infection and associated mortality outcomes, especially among children under 24 months and poor households across multiple regions, raises important questions on the adequacy of the provisions in the policy guidelines and sequelae practices not only in treating diarrhoea morbidity but also preventing infections in Kenyan children. The knowledge gaps identified in the literature relating to the etiological diagnosis, introduction of diarrheal vaccines, and the role of environmental enteric dysfunction and severe acute malnutrition,[17] underscores the importance of further search for policy gaps and options together with interventions that work in communities where prevalence remains high and infrastructure is inadequate.[18]

The overarching aim of this review is to answer the question of whether national policies, legal frameworks and operational guidelines are adequately addressing the determinants, prevention and treatment of enteric infections and diarrhoea among under-5-year children in Kenya. The more specific objectives are to identify country-specific gaps in the policies that need to be filled through policy and practice changes to strengthen interventions in the prevention and treatment of diarrhoea morbidity and reduce related mortality among under-5 children across the different sources of exposure in Kenya. The overall goal is to identify the pathways to achieve more effective enteric and diarrhoea infection prevention and management policies, with determined actions and multimodal intervention strategies.[19]

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METHODS

A landscape analysis is undertaken to monitor and characterise all the products that exist or are being developed in a specific topic area, using various sources and tracking processes.[20] Depending on the questions needing answers and available resources, landscape analysis can be as focused or broad and follows the critical steps of knowing your questions, developing the method, collecting the data, analysing and visualising the results, dissemination of findings and planning for updates.[20] Landscape analysis identifies the elements of the current product, characterising their strength and weaknesses, identifies the knowledge and information gaps that will need to be addressed to inform the development of the priority research needed and supports advocacy to incentivise investment and decision-making for the greatest public health gains.[20]

Our current landscape analysis seeks to identify the gaps in the current Kenya diarrheal policy vis-à-vis their comprehensiveness and the availability of elaborate treatment, management and prevention solutions. We interrogated their updatedness building on evidence from extant literature on key pathways to infection relating to the man-animal-environmental interactions, which are critical to the generation of evidence that can inform policy change, priority setting and ultimately action to effectively address the needs of low-income and middle-income countries (LMICs).[21] The review is part of a larger short-period cohort study on Urban Societal Development and the Ecology of Enteric Disease Transmission among Infants, Domestic Animals and the Environment.[22] The project is in response to persistence of global morbidity and mortality from enteric infections and diarrhoea in LMICs, despite significant investment over recent decades in health systems and global water and sanitation infrastructure.[22] Our review is guided by the theoretical framework for policy content analysis and determinants of health policy impact, developed by Rütten and colleagues in 2003. It states that the success of any policy to achieve the intended behavioural change in the population is based on the policy-related determinants that include concrete goals, sufficient resources and public support, as well as implementation-related personnel commitment and organisational capabilities.[23] Consequently, our areas of analysis of the prevailing policies on the management and prevention of diarrheal diseases in under-5 children in terms of adequacy of contents and gaps are articulated in the attached conceptual framework (figure 1).

Inclusion and exclusion criteria

Our data sources included a desk review of publicly available key national diarrheal policy frameworks, plans, strategies, laws and operational guidelines to inform pertinent questions on the state of play relating to the adequacy of policy and practice and to inform preventive policy updates and action options. The documents included consisted of (1) laws and regulations that provide a supportive environment for diarrheal control and management by setting the overall framework and standards for service delivery, (2) institutional frameworks in which diarrheal management is positioned as part of the rights and responsibilities delegated or assigned to institutions[24] and (3) peer-reviewed and grey literature on diarrheal morbidity and mortality and diarrheal prevention and management. In terms of years, the search was consciously open-ended to allow for the much-needed historical background and evolution in policy and research undertakings in Kenya over time. The analysis excluded any information that was not referenced on the internet nor obtained from the internet.

Search strategy

Data collection's first step in landscape analysis is finding out who has the information—databases, internet searches, reports, literature searches, patient groups, key institutional actors and private and non-profit sectors.[20]

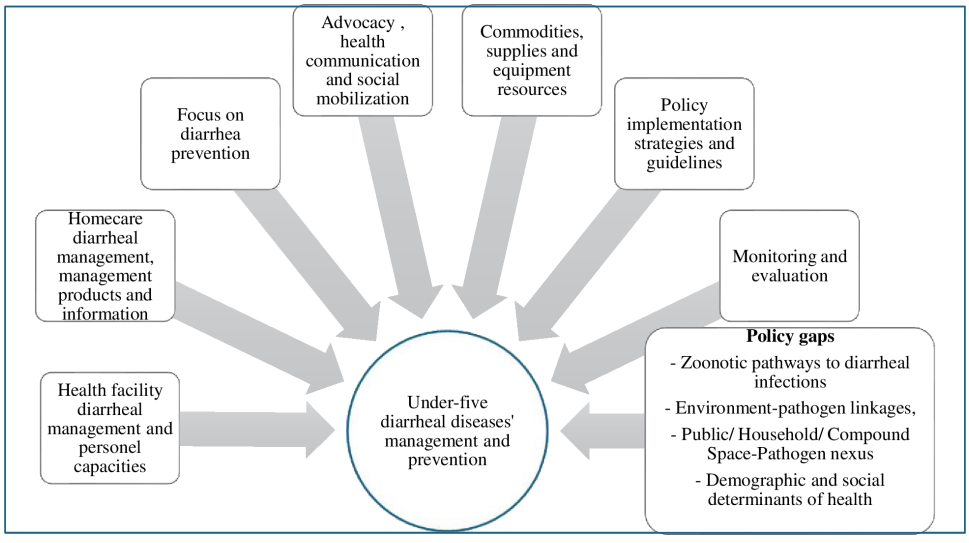


Figure 1 Policy guidelines conceptual framework for management and prevention of diarrheal diseases among under-5 children in Kenya.

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We searched for relevant policy documents (laws, regulation, guidelines, standards and operational manuals) developed and adopted for enteric infections and diarrheal disease prevention and management in Kenya, together with related peer-reviewed publications and grey literature. The search strategy involved an internet search of current and historical policy and policy-related documents. We searched various databases, with a particular focus on (1) the Government of Kenya's Ministry of Health; (2) published and grey literature (Google searches, Google Scholar and PubMed) and (3) relevant websites/publication databases of international organisations and groups addressing enteric infection and diarrhoea in Kenya (Centre for Disease Control and Prevention, UNICEF and WHO). Key search terms included: 'Kenya diarrhea policy', 'enteric infection Kenya', 'diarrhea Kenya', 'diarrheal correlates', 'diarrhea interventions in Kenya', 'enteric infections among children below five years', 'prevalence of diarrhea in Kenya', 'prevalence of diarrhea among under-five', 'treatment of diarrhea', 'diarrhea research', 'causes of diarrhoea in Kenya', 'diarrhoea mortality in Kenya' and 'Kenya treatment guidelines for diarrhoea'. Each search term and changes in the search terms and questions led to an extensive collection of literature from which relevant documents clarifying the nature of the topic were selected for further analysis, building on team members' technical expertise and individual judgement and experience.

The initial search was conducted from February to April 2022, with additional searches conducted during the report drafting and review processes, with the last search dates being June 2023 at the conclusion of internal reviews of the draft manuscript and the response to peer reviewers' comments in June 2024.

Policy documents and literature screening and assessment

After retrieval, a cursory assessment of the publications was performed to determine their quality (or the degree to which it minimises the risk of bias), relevance and building on the principles of credible research enquiry in terms of subject and context appropriateness, cultural sensitivity, transparency and internal and external validity, as well as reliability and cogency, using guidelines for assessing the strength of evidence of research studies developed by the Department for International Development.[25] In general, we selected and reviewed 55 documents that directly or indirectly address enteric infections and diarrhoea in children in Kenya. Beyond the 2014 policy guidelines currently in use in Kenya, three key policy documents related directly to the management of diarrhoea in children that evolved between 1993 and 2010 were retrieved and reviewed: The Policy Statement on Control of Diarrheal Diseases (1993);[13 14] the Child Survival and Development Strategy[26] and the National Health Sector Strategic Plan II (2005–2010).[27] Also reviewed is the related[6 6] and the Kenya Health Policy, 2014–2030,[28] which is an umbrella document that binds together various guidelines, strategies, frameworks and plans that were developed over time to ensure significant improvement in the overall status of health in Kenya, in line with the country's 2010 constitution.[29] These include the Kenya Health Sector Referral Strategy (2014–2018);[30] Kenya Health Sector Strategic and Investment Plan 2013–2017;[31] Kenya Community Health Strategy 2014–2019;[32] Kenya Primary Health Care Strategy Framework 2019–2024[33] and Norms and Standards for Health Service Delivery.[34] In summary, these guidelines, standards and strategic frameworks, retrieved from the Government of Kenya sources, especially the Ministry of Health, Kenya National Bureau of Statistics and international research and intergovernmental organisations (African Population and Health Research Center, UNICEF, WHO and other UN agencies), were aimed at achieving targets related to the elimination of communicable diseases, minimisation of exposure to health risks, provision of essential healthcare and strengthening intersectoral collaborations towards improving overall population health in Kenya. Finally, majority of the publications reviewed[29] were peer-reviewed articles published between 1989 and 2023 and primarily on or relevant to Kenya and the sub-Saharan African region. The documents selected and reviewed are summarised in online supplemental appendix table 1.

Extraction/abstraction of information and content analysis

The review team extracted the key provisions of the policy guidelines guided by a checklist and questions around the adequacy of existing national policies in addressing the determinants, prevention and treatment interventions of enteric infections and diarrhoea among under-5-year children in the country. The checklist covered Kenyan background and diarrhoea situation analysis, policy objectives, policy strategies and policy implementation. The critical questions asked to the policy guidelines, action plans, strategic frameworks and relevant literature are summarised in online supplemental appendix table 2.

Patient and public involvement

None.

RESULTS

Key provisions of the policy guidelines

The 2014 policy guidelines on childhood diarrhoea among under-5 children identified a corpus of strategies, which included Integrated Management of Childhood Illnesses (IMCI) strategy, integrated community case management, prompt and effective facility-based case management, prevention of diarrhoea, advocacy, health communication and social mobilisation and logistics management.[13] These are specifically elaborated under the following subheadings.

Management of diarrhoea and capacity building of personnel

At the level of the formal health system, health facility case management by healthcare providers, including doctors, nurses, clinical officers, nutritionists, pharmacists and

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public health officers in public, private and faith-based facilities, was identified as a critical route for diarrhoea management in children under 5-years old. Further, capacity building was a cardinal strategy, with the policy advocating for strengthening the necessary human resources through training and orientation to target health managers, in-service health workers, community health volunteers (CHVs) and medical training institutions.[13] All facility-level healthcare workers managing children, including nutritionists, public health officers, and community health extension workers (CHEWs), were identified for training on IMCI.

The Kenya Health Sector Strategic Plan 2018–2023, identified five main areas that should improve the overall health in homes or communities.[35] These include establishing a special fund for the remuneration of community-level health workers, increasing the number of CHEWs and CHVs and the use of the Kenya Medical Training College curriculum to train and certify a critical mass of community health assistants with a view to ensuring the provision of preventive and promoting healthcare at the community level. The Kenya health policy, through the scaling up strategy for essential treatments in children under 5 years, presented a blueprint for the acceleration of the control and management of childhood diarrhoea and pneumonia.[35] One of its key strategies was to expand access to integrated case management of childhood illnesses at all levels in healthcare service delivery across the public and private sectors and increase public awareness and generate demand for diarrhoea and pneumonia management in children under 5 years.

Home management and provision of product information

Targeting the home front, home-based management and the empowerment of parents and caregivers of under-5 children to give early diarrhoea treatment at home were highlighted in the 2014 guidelines. Further, the 2014 guidelines emphasised increased fluid intake to prevent dehydration when diarrhoea starts. This was supported with specific recommendations on specific fluids such as breast milk, cereal gruel, fresh and fermented milk, fresh fruit juices, soups prepared from meat, fish and chicken, ORS and clean, safe water. The guidelines also included product information on ORS and zinc sulphate and their benefits, including the use of appropriate doses of vitamin A and intravenous therapy, as well as detailed conditions where other antidiarrheal agents would need to be applied or otherwise.

Focus on diarrhoea prevention

The 2014 policy guidelines identified the prevention of diarrhoea as part of averting diarrhoea-related mortality and stunting in infants and young children. The policy highlighted cost-effective preventive interventions and called for their promotion: early and exclusive breastfeeding, rotavirus and measles vaccination, vitamin A supplementation and hand washing using running water and soap, particularly at four critical times (before preparing food, before feeding the baby, after visiting a toilet and after changing baby's napkins). Other preventive activities included improved water supply quantity and quality, treatment and safe storage of household water and proper disposal of human faeces, including that of babies.

The community health policy 2020–2030,[35] which draws its suggestions from, among others, the community health strategy 2014–2019 and the Kenya health policy 2014–2030, recognises the need for addressing key social and environmental determinants as preventative measures. It pointed to poor sanitation and hygiene, inadequate water supply, environmental factors and malnutrition as contributors to the sustained high prevalence of infectious diseases, with diarrheal diseases among the top three leading causes of under-5 mortalities.

Advocacy, health communication and social mobilisation

Advocacy was outlined in the 2014 diarrheal policy as being fundamental to resource mobilisation, partnership enhancements with political and social leadership to build support, building acceptance and commitment for diarrhoea management and prevention both at national and county levels. The policy emphasised the promotion of approaches to engage the participation of the communities to share health-related information with the goal of adapting and sustaining behaviour change practices for diarrhoea management. This was to be realised through the development of appropriate, accurate and culturally acceptable messages to be disseminated through a variety of channels including electronic media, information, education and communication (IEC) materials, community social mobilisation and school health programmes. The strategy includes rallying of communities through dialogue and consensus towards demand creation and increasing uptake of diarrhoea management interventions.[13]

Relatedly, the Kenya Health Policy 2014–2030 formulated various strategies for providing affordable and quality healthcare through essential healthcare services. This includes ensuring the provision and sharing of complete, reliable, timely, efficient and effective health management information for healthcare among all stakeholders in the sector. Further is the planning, design and installation of information, communication and technology infrastructure and software for the management and delivery of care.[28]

Commodities, supplies and equipment

The 2014 policy guidelines presented a clear and elaborate plan for every service delivery point at health facilities that serve children under 5 years to be adequately equipped with relevant resources for diarrhoea management. All healthcare facilities at all times were planned to have under-5 registers, ORT corner registers, case management summary tools, guidelines, job aids, IEC materials, drugs and equipment and supplies at the main entry points for children. A commodity management

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system, which enhances the visibility of procured drugs, equipment and supplies was to be promoted to strengthen the availability of diarrhoea management commodities.

According to the Community Health Policy 2020–2030, the community health workforce needed to be provided with the necessary commodities, supplies and tools to help them carry out their duties effectively.[36] This was meant to be done by ensuring commodity security, quality and safety of community health supplies and digitising and integrating the community health supply chain into the national commodity management system.

Policy implementation strategies and guidelines

The 2014 policy guidelines highlighted specific guiding frameworks for its implementation, which included the Child Survival and Development Strategy 2005–2010, the WHO and UNICEF-designed IMCI Strategy 2014, the Integrated Community Case Management Framework and Plan of Action 2013–2018[37] and the National Diarrhea and the Pneumonia Implementation Plan.[13] These strategies and guidelines were also supported with clinical practice guidelines for use by health workers for the prevention and management of diarrhoea at all levels.[13]

Similarly, strategies and guidelines were set out to ensure a successful implementation of the Kenyan Health Policy 2014–2030, with norms and standards set to guide efficient, effective and sustainable delivery of health services and to ensure a healthy population. Among the norms and standards included the treatment of childhood illnesses following IMCI guidelines and functional ORT corner, which are designated areas in health centres staffed by health workers who have been trained in diarrhoea/dehydration for immediate start of on-site rehydration of children with diarrhoea.

Health education was identified as a critical implementation strategy, with a specific focus on key messages on control of childhood illnesses, growth promotion and monitoring, vitamin A supplementation, nutrition education, promotion of exclusive breastfeeding for 6 months and proper nutrition according to the IMCI protocols.

Monitoring and evaluation

The 2014 policy identified monitoring and evaluation as crucial to implementation success. For increased visibility and informed decision-making, the District Health Information System was to be used to report diarrhoea cases, classification and treatment for children below 5 years. Appropriate monitoring indicators were caseload and degree of dehydration and treatment. Counties were mandated to ensure all facilities were equipped with relevant data collection and reporting tools: under-5 registers, ORT corner register and under-5 summary sheets. The policy defined community data collection tools: sick child recording form, CHVs treatment and tracking registers, CHEWs monthly summary and commodity registers.[13] Emphasis was on complete, accurate and timely data capture and use. Relatedly, the policy encouraged targeted operational and other research as well as promotion of the utilisation of research findings to inform the policy and guide the implementation process.

DISCUSSION

Despite detailed and crisscrossing provisions of policy guidelines, frameworks and action plans presented above, together with several dimensions of consequent interventions, diarrhoea remains among the top five causes of mortality and morbidity, particularly among infants and children below 5 years in Kenya,[38] and prevalence highest among the urban poor.[39] Across the country, household case management of diarrhoea remains inadequate for a substantial proportion of children.[39 40] These persistently grim scenarios engendered our further questions on the missing gaps in the current policies, frameworks and action plans vis-à-vis their comprehensiveness, the availability of elaborate treatment, diarrhoea management and prevention solutions. In our interrogation and triangulation of evidence from the literature, we identified the following gaps in the policy documents, guidelines and action plans.

Lack of focus on zoonotic pathways to diarrhoea infection

Although the use of the policy guidelines has been identified as effective in addressing diarrhoea infection over time, they lack focus on some key pathways to infection, for example, the man-animal-environmental interaction, which researchers suggest is critical in effectively addressing the needs of LMICs and communities.[41] This is important, following the growth of slum environments and the increasing uncontrolled human-animal interactions that could be associated with health risks. Previous research has established linkages between human diarrheal infections and domestic animal husbandry.[5 42] A systematic review and meta-analysis found consistent evidence of a positive association between exposure to domestic food-producing animals and diarrheal illness across a range of animal exposures and enteric pathogens.[42] Out of 29 studies included in their review, 20 (69.0%) reported a positive association between domestic animal exposure and diarrhoea, with domestic exposure to poultry revealing a substantial association with human campylobacteriosis. It was concluded that exposure to domestic animals should be considered a risk factor for human diarrheal illness and recommended additional studies to identify potential mitigation strategies to address the risk.[42]

Similarly, Penakalapati and colleagues' 2017 study underscored how humans can be exposed to pathogens from poorly managed animal faeces, particularly in communities where animals live in close proximity to humans via water, sanitation and hygiene-related pathways and where household livestock, small-scale animal operations and free-roaming animals are common.[5] Exposure to animal faeces was linked to diarrhoea, soil-transmitted helminth infection, trachoma, environmental enteric dysfunction and growth faltering. The authors postulated

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that interventions such as reducing cohabitation with animals, provision of animal faeces scoops, controlling animal movement, creating safe child spaces, improving veterinary care, and hygiene promotion are important in breaking the barrier in infections.[5] These interventions, though not new, are largely lacking in current policy guidelines, frameworks and action plans. The proposed future research agenda included evaluating behaviours related to contact with animal faeces; animal faecal contamination of food; cultural behaviours of animal faecal management; acute and chronic health risks associated with exposure to animal faeces and factors influencing concentrations and shedding rates of pathogens originating from animal faeces.[5] This elaborate research agenda highlights the gaps in policy and practice in diarrhoea management and prevention in Kenya and reiterates the evidence that zoonotic pathways contribute to diarrheal infections. This is largely not emphasised and operationalised in the current policies and guidelines for the management and prevention of under-5 diarrhoea in Kenya.

Environment-pathogen linkages

Measuring the complexities of pathogens in the environment is essential for understanding transmission dynamics across human populations. Evidence from urban Kenya and Haiti revealed that young children, including infants, ingest high doses of a wide array of enteric pathogens from exposure to soil, surface water and objects during play in community areas.[3 4 43 44] Furthermore, increased spatial movement of children around the community increases the probability of ingesting new types of pathogen species.[35] These different environmental diarrhoea transmission pathways have been historically and clearly illustrated in LMICs[22] but remain generally absent in current policy and intervention guidelines in Kenya.

Similar to vaccine interventions, a certain threshold of household and community-level sanitary conditions is suggested to be required for the evolution of a population from multipathogen, high-prevalence disease burden to rare pathogen-specific disease outbreaks.[45] A combination of societal development improvements that may be required to achieve multipathogen herd immunity was identified, which include shifts at the point of faeces generation such as latrines and sewers or animal management and shifts in basic household or neighbourhood conditions such as concrete floors or increased wastewater drainage. The current diarrhoea management policy frameworks and guidelines for management of child diarrhoea for Kenya is lacking emphasis in these environment-pathogen prevention pathways.

Limited focus on rapid diagnosis, vaccine development and deployment

Whereas the policy was projected to lead to rapid management, treatment, prevention and control of diarrheal diseases, it remains limited in offering rapid diagnosis, especially as a fair proportion of diarrheal pathogens are difficult-to-culture and yet-to-be-identified.[46] Out of the five pathogens that predominate low-income settings: *Cryptosporidium*, *Shigella*, non-typhoidal *Salmonella* and enterotoxigenic *Escherichia coli,* vaccines are only currently available against rotavirus, whose rollout also remains limited and concentrated among upper-middle-income or high-income countries.[17] The Kenyan policy recognises rotavirus but did not seem to anticipate the challenges of its availability and modalities for its delivery to under-5 children across the country. Moreover, the development of vaccines beyond rotavirus is not captured.

Limited focus on demographic and social determinants of health

The 2014 policy elaborates on home and health facility management, though weak on how to operationalise the social determinants of health. Studies in Kenya and elsewhere have shown that ages of life may fairly protect infants against bacterial infections, as the host immunity heightens with advances in age.[47 48] Related to the age of the child is the timing of complementary feeding which may result in frequent bacterial infections causing diarrhoea, with introducing food at 6 months linked to elevated probable bacterial infections.[48] An important demographic factor in the literature is gender. Female participants (between 6 months and 36 months in Kenya and <5 years in rural Sudan) were found in some studies to be nearly twice more likely to be infected with enteric pathogenic bacteria than their male counterparts, which may be attributed to the differences in their immune systems and other physiological factors.[47–49] The focus on sociodemographic factors is lacking but needs to be accounted for in both policy and action around diarrhoea infection prevention and management moving forward.

Weak funding commitment and unclear pathways

The 2014 policy guidelines gave a clear recognition that adequate resources will be needed to implement its provisions. However, it only encompassed a statement of advocacy without defined funding targets and specific funding responsibilities. The policy called for advocacy for appropriate financial mobilisation by all partners in healthcare provision: medical training institutions, faith-based organisations, the pharmaceutical industry, development partners and the community.[13] Further, it envisaged that resource allocation for child health programmes will be increased so that the strategies outlined in the policy can be achieved. The strategies targeted for implementation are capacity building, strengthening health systems and empowering families and communities to take charge in the prevention and management of diarrheal diseases. Successful implementation of the policy was anchored on the coordinated action of many sectors and the participation of all stakeholders in the health sector. Despite this articulation, the pathways to financing the implementation of the policy were not clearly identified. Advocacy was adopted as a key approach to mobilise resources and enhance partnerships with political and social leadership

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in order to build support and commitment for diarrhoea management and prevention. Notwithstanding, the costing and funding targets were lacking in the policy and the pathways for resource mobilisation and enhanced partnerships were not identified.

Monitoring and evaluation indicators lacking contextual nuances

Monitoring and evaluation were identified as crucial pathways to implementation success, as well as appropriate indicators to be monitored, including caseload, degree of dehydration and treatment. However, risk factors for diarrhoea vary geographically and spatially, and determining Kenya's in-country diarrheal prevalence and its associated risk factors will be needed to provide a basis for focused interventions by local implementing agencies and enable equitable resource allocations in public health.[50] While national indicators may be generally available, they blur intersubgroup and intrasubgroup inequities and often lack aggregation at local levels, especially among marginalised groups as slum dwellers in urban informal settlements, where the needs are located and where progress needs to be measured and priorities deciphered.[51]

Study limitations

Our analysis was based on a document review of the existing policies and extant literature, so we were not in a position to identify some of the processes implemented in practice that can affect enteric infection policies, management and prevention outcomes. Critical evaluation of real interventions and their appropriateness for target audiences may be as important as policy options and associated campaigns themselves and necessary to establish the effectiveness of current interventions. Critical questions on what has been achieved? What gaps need to be addressed? And what levels of investment are still needed at different health facility and community levels? will need answers moving forward.[52] Therefore, future research agenda will need to include how the policies are implemented in practice and across subgroups, communities and regions. This will enable an evaluation of where and how the policy meets the people and where participatory approaches and collaboration mechanisms will be developed. Further interrogation of the actors that participated in policy formulation and implementation strategies will need to be engaged in relation to health system preparedness in incorporating research evidence in policy and implementation decisions. Notwithstanding, our study has made an important contribution by identifying what is and what is not in the policies and specific factors that may be contributing to the failure to address some critical pathways to enteric infection, management and prevention related to zoonotic, environmental and social determinant factors, which will inform not only research but policy updates and practice improvements.

CONCLUSION

The complexity of pathogen pathways and subsequent enteric infection and diarrhoea-related morbidity and mortality in under-5 children points to the linkages between the efficacy of policy-making and intervention designs. This calls for policy guidelines that address multipathogen presence and persistence in the environment, the role of animals as mobile vectors of disease, and that recognises how evolution in societal development shifts the complexity of enteric pathogen transmission to children.[18] Particularly, new policy guidelines must consider the features of the urban environment which can contribute to these causes of death.[53]

Our analysis has highlighted the need for policy update to reflect pathways to enteric infections not covered in the current policy guidelines in Kenya. This review highlights that beyond postulations and commitments, there is a need for definitive actionable pathways and operationalisation of key service provisions. While Kenya's national policy guidelines are instrumental, hindering gaps to their maximum implementation remain. Consequently, amendments to the legal and policy provisions to respond to these gaps will be critical in averting diarrhoea, maximising its management and achieving the overall quality of life of Kenya's under-5 children. The push towards diarrhoea prevention through addressing the operationalisation of key social determinants of health, such as controlling animal-human interactions, provisions of water, sanitation and hygiene services, healthy housing and poor environmental challenges, needs to be prioritised, especially across urban slum settlements and marginalised communities in Kenya and other LMICs.

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Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. The policy landscape analysis study paper will be open access when published and so available for all and sundry. No additional data will be available. For the larger Pathome Study, which will collect human, animal, household and environmental data, we will publicly share the large datasets we collect, thereby providing an invaluable asset to other modelling groups working on reducing incidence rates of enteric pathogen infections in children in LMICs. In Kenya, the data will be shared through APHRC data portal after approval through an application process.

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