

Environmental Parasitic Disease Affecting the Health

Status in Rwanda

Holly Burns

Public Health Epidemiology, Walden University, Minneapolis, MN

Abstract. The analysis gleaned from Rwanda's history following the 1994 genocide to the post-war aftermath has provided the ability to examine the improvements in life expectancy, health care, and social disparities within this country. The following paper describes Rwanda's environmental and social health determinants, examines health literacy, and evaluates the inequalities within this country. Understanding the multiple influences surrounding the ecological living conditions that lead to tungiasis was pursued to reduce the prevalence of the parasitic disease. Policies should be established to enhance better environmental living conditions so Rwandan citizens can overcome several health barriers. Low socioeconomic status is associated with impoverished housing conditions and unhygienic living environments. Poor housing conditions, elevated indoor relative humidity levels, and unhygienic living environments expose Rwandan citizens to bacterial, viral, and parasitic risks. Therefore, examinations of peer-reviewed scholarly articles assist with determining the efforts used through governmental policies and programs to reduce health disparities in Rwanda. Finally, developing policies can help reduce exposure to a prevalent parasitic disease affecting many Rwandan individuals. Rwanda has many obstacles to reducing exposure to tungiasis, like managing healthy living environments, large city populations, access to quality sanitation systems, contaminated water, and funding for improved water treatment. Approximately 23% of the participants in three primary schools acquired tungiasis by walking barefoot in the sand, with unclean feet, in poor living environments, with elevated relative humidity levels, and in impoverished housing with dirt floors [5 & 12]. Aligned with overcoming Rwandans' barriers, tungiasis can be reduced and eliminated through paved concrete floors in residential housing, controlling indoor atmospheric conditions, education on tungiasis, knowledge of proper hygiene, environmental remedies, social policy reformation, and cultural modifications. In conclusion, goals should be established to create social change to protect at-risk Rwandan citizens from exposure to Tungiasis, especially school children.

1 Rwanda's Social Health Determinants

1.1 History of Rwanda's Social Health Determinants

- Rwanda has been an interesting country examined by the world because of the 1994 genocide and civil unrest. Prior to the genocide, the life expectancy in 1993 was 47.2 years [6]. During the massacre of the national rebellion in 1994, which resulted in genocide, the life expectancy was less than ten years old for Rwandan citizens [6]. After the "100 days of slaughter," which began on April 6, 1994, approximately 800,000 individuals died due to the Hutu extreme rebels' desire for power and their vicious discrimination of the Tutsi population [3]. The genocide ended in July of 1994 when a new government led the rebel and Ugandan army to block the ethnic genocide by the Hutu extremists [2]. Rwanda began rebuilding its country by implementing new policies to further economic growth and become a more egalitarian society [3]. The life expectancy in 2018 was 68.3 years. The transformation was instrumental to the health and well-being of the Rwanda population.

1.2 Rwanda's Health Care System - The health care system established in Rwanda is remarkably equal to or better in some areas than in many rich countries. Rwanda's Ministry of Health has established policies to ensure all citizens are within every social class [15]. According to Rosenberg (2012), 96 percent of the

Rwandan population has health care coverage [15]. Rwanda's government has been devoted to improving health care by emphasizing health policies, such as family planning [7]. Several economic developments have positively enriched Rwanda's economic growth to assist with funding its health care system [8]. According to Wilkinson and Pickett (2010), countries that support innovative ideas improve inequality [19]. Rwanda's economic growth, sustainability, and healthcare advancements create a safer, happier, and healthier nation.

1.3 Rwanda's Social Health Determinants - Rwanda has many social determinants of health affecting the positive health outcomes for the Rwandan people. The universal healthcare system has propelled Rwandan citizens to a greater life expectancy. Ninety percent of the population has received immunizations and vaccinations, the expenditure on health has decreased to less than one percent, infant mortality has fallen, and HIV deaths have declined [20]. Reformed government health care policies adjusted co-pays based on an individual's income level [15]. Therefore, the health care system improved many aspects of an individual Rwandan's economy, health, and well-being.

However, there are social health determinants that Rwanda is continuing to improve. Policies to enhance

better environmental living conditions, housing, access to quality health care, gender health practices, and hygiene are determinants that Rwandans are striving to overcome. Additionally, low socioeconomic status creates adverse health conditions for many Rwandan people. As Nsanzimana et al. (2019) reported, low socioeconomic status correlates to impoverished housing conditions, the inability to purchase protective clothing attire, improper floor-type characteristics, elevated atmospheric conditions (temperature and relative humidity), and unhygienic living environments [5 & 12].

The social health determinants previously mentioned influence the impact on the Rwandan people by allowing an opportunity for exposure to many diseases and infections. Poor housing conditions and unhygienic living environments expose this population to bacterial, viral, and parasitic risks. Unhygienic practices result in gastrointestinal viruses and dermal diseases. According to Mourad, Habumugisha, and Sule (2020), Rwanda has many obstacles to overcome in managing healthy living environments, such as large city populations, access to quality sanitation systems, contaminated water, and funding for improved water treatment [10].

2 Tungiasis is a parasite that individuals are exposed to in tropical and sub-tropical low socioeconomic settings [12]. In a study performed by Nsanzimana et al. (2019), approximately 23% of the participants in three primary schools acquired tungiasis by walking barefoot in the sand, with unclean feet, poor living environments, and impoverished housing with dirt floors [12]. The result of developing tungiasis, a small flea-like parasite that burrows under the skin's epidermis, involves intense itching and pain around the site, difficulty walking, bacterial infections, and gangrene [4]. Consequently, tungiasis for a school-aged child creates low school attendance due to difficulty walking, lack of concentration because of the pain and itching, decreased school performance with lower test scores, and isolation caused by social humiliation from peers [12].

However, tungiasis can be mitigated using concrete or paved flooring systems and controlling the temperature and relative humidity levels [5]. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) recommends a relative humidity range between 30%-60% for optimal thermal comfort [1]. In a randomized field sampling study performed by Enwemiwe (2017), thirty (30) ($n = 30$ houses) houses were randomly selected within three mapped locations to determine if the floor type and psychrometric atmospheric measurements were significant to cause tunga pentran (jigger flea) infestation [5]. The three areas mapped for tunga pentrans infestation were Zion, Kofawe, and Laranda [5]. The randomly selected properties were sampled weekly for tunga pentrans and bi-weekly for atmospheric conditions [5]. The study results showed that 62.1% of the sampled houses had a

significant amount of flea infestation among houses with unpaved floor types, and 3.5% of fleas were found in homes with paved floor types [4]. The flea's life cycle depends on temperature and relative humidity levels [5]. The temperature suitable for flea infestation is 25°C-35°C, and between 65%-75% relative humidity levels are optimal for insect survival [4]. Unpaved floor types had the highest mean temperature of 33.5°C [5]. The mean relative humidity within the three areas sampled was 70% in Kofawe, 68.6% in Zion, and 68.9% in Laranda [5]. The atmospheric conditions make these properties ideal for flea infestation [5]. Additionally, organic debris, waste dumping sites, and human feces near residential properties have been commonly linked to flea abundance [5]. Therefore, tungiasis can be reduced and eliminated through cementing unpaved floor types, reducing temperature and humidity levels, education on tungiasis, knowledge of proper hygiene, environmental remedies, social policy reformation, and cultural modifications.

2.1 Issues Relating to Health Literacy and Cultural Awareness in Rwanda - Very little information is known regarding the impact and consequences of acquiring tungiasis, so the Rwandan population needs to improve health literacy [12]. However, in a hygienic study performed by Mourad et al. (2019), on the sanitation practices of human waste, 50-99% of participants could not relate hygiene to bacterial diseases resulting from contact with contaminated water [10]. The study by Mourad et al. (2019) exhibited the lack of health knowledge many school-aged participants possess correlating with proper hygiene to reduce diseases associated with contacting or consuming contaminated water [10]. Unsanitary practices generate an environment prone to gastrointestinal, bacterial, and parasitic infections.

In a study completed by Waterkeyn et al. (2020), several Community Health Clubs (CHC) in Rwanda consisting of 4,056 members were surveyed, monitored, and trained over three years to examine hygiene and sanitation practices within households and communities [18]. A considerable amount of cultural, environmental, and social barriers were indicated in the study, which delineated positive health outcomes [18]. According to Waterkeyn et al. (2020), a few of the cultural, environmental, and social blockades were changing adverse attitudes associated with hygiene, shortening the time frame for training and educating members on personal and environmental sanitation, and shifting the mindset of necessities and priorities of households and the community at large [18]. Paradoxically, over seventy percent of the members improved their living conditions by choosing alternative health options the three years following the study [18].

3 The Relationship Between Health Inequality, Inequity, and Life Expectancy in Rwanda

Following post-genocide in Rwanda, life expectancy has continually increased throughout the past twenty-six years [6]. Improvements to the health care system via governmental policy changes within the Ministry of Health now provide insurance for ninety-six percent of the population within Rwanda. Furthermore, a sliding scale for co-payments based on individual income has allowed more participation within the health care sector [15]. Rwanda is one of the first countries to utilize technology-based drones to deliver approximately 150 blood vials daily to hospitals and clinics [17]. As Rutkin (2016) reported, the hope is to expand medical drones to deliver vaccines [17]. Therefore, governmental policy improvements and technological advancements have increased Rwanda's life expectancy.

A significant inequality in health care was observed from 2005-2010 between social gradients in Rwanda [9]. The reduction of health inequity was transformed when the government decided to reduce disparities by funding the healthcare system to assist with premiums and co-payments for lower socioeconomic residents [15]. Since 2011, the Rwandan government has subsidized health insurance to provide equal distribution across the country [9]. Universal health care in Rwanda has allowed for a more equitable share of health care services.

4 Two Current Efforts in Rwanda to Reduce Health Inequities

Rwanda has made significant advancements in reducing health disparities between social classes. In 2000 the government decided to focus on programs, such as the performance-based financing (PBF) policy, to concentrate on financial strategies to reduce the social gradient gap within maternal health services [13]. According to Priedeman Skiles et al. (2013), the government incentivized health providers and medical facilities to subsidize premiums and co-payments [13]. Provisions for monetary incentives to health care facilities and providers have expanded the interventions for women by 8.1 percent [13]. However, Rwanda's rural regions in low socioeconomic classes are still overcoming the issues of understaffed medical facilities [13]. The financial stimulus included additional training and supervision, bonus opportunities, equipment replacement allocation, and community outreach programs [13]. Exceptional progress has occurred in decreasing inequality and reducing disparities within health care. According to Ross (2015), contraceptive use occurs in rural areas less than in metropolitan areas [16].

Social gradients based on income have reduced, and economic wealth has increased within low

socioeconomic countries in the past two decades [16]. Based on the study by Ross (2015), the contraceptive prevalence rate (CPR) shows that the gap in CPR rose among the poor community, but the CPR gap grew even more among the affluent population [16]. The concentration of maternal health care policies in Rwanda has decreased the morbidity and mortality rates associated with skilled female health practitioners, proficient neonatal care, and contraceptive use [21].

Violence among women in the healthcare system has been a concern for many years. Violence has been defined as physical violence, verbal abuse, harassment, and sexual or racial discrimination [11]. According to Newman et al. (2011), thirty-nine percent of female health workers were exposed to workplace violence within the prior year of the study [11]. As reported by Newman et al. (2011), in 2007-2008 IntraHealth International collaborated with Rwanda's Ministry of Health to initiate policies to reduce gender inequality and violence within the health care arena, retain health care workers, improve efficiency and productivity in medical facilities, and enhance safety, gender equality and human rights [11]. President Paul Kagame stated Rwanda had made improvements to gender equality and has assisted with empowering the female population [14]. The Republic of Rwanda Ministry of Gender and Family Promotion (2010) developed several policies and programs for gender equality to augment the social structure, provide cultural awareness, increase political involvement, and support socioeconomic empowerment for the female community [14]. The Rwandan government continues to monitor and revise policies and programs within the Republic of Rwanda Ministry of Gender and Family Promotion [14]. Due to the issues with understaffed medical facilities to serve the Rwandan population's health, closing the inequality gap and reducing violent acts upon female workers in healthcare facilities can only promote better health outcomes for the citizens of Rwanda. If assistance can be provided for gender equality in Rwanda, then the government can help reduce and eliminate the prevalence of tungiasis, especially among children.

5 Tungiasis Health Policy in Rwanda

Action to promote awareness and education and implement governmental policies for the risks of tungiasis include a curriculum on hygienic practices within the primary classroom setting. Additionally, government funding and incentives for construction workers to provide concrete monolithic slabs within the indoor living environment to cover earthen dirt floors would reduce the ability for tungiasis to occur. Furthermore, developing a program that includes the entire family and social ecosystem to disseminate knowledge on the adverse outcomes of unclean and unhealthy living environments, the significance of controlling indoor atmospheric conditions, and the importance of foot protection through adequately fitted shoes would be necessary. Moreover, collaboration with community members to gain positive participation in

developing, implementing, and revising community programs and policies to reduce tungiasis is critical.

Coordination with primary school systems to detect issues related to the lower extremities, such as the child's feet, would assist the child and family members in enacting change within their environment. The curriculum within the academic setting would encourage proper hygiene to avoid a parasitic invasion under the skin. Acemia would also increase awareness of the disease, which can lead to inflammation, bacterial infection, and potentially gangrene. The consequences of contracting tungiasis lower a student's school performance, making the school setting a perfect place to instruct healthy hygiene practices to avoid parasitic, opportunistic diseases.

Government subsidies and incentives for contractors within local communities to provide concrete monolithic foundations would assist lower socioeconomic populations with an infrastructure to support a hygienic environment. In addition, adding ventilation controls to reduce temperature and relative humidity levels would also support economic growth and mitigate tunga pentrans infestation. Instruction on maintaining a clean indoor living environment would decrease the risks of tungiasis. Regulatory policies to inspire equitable living conditions with proper construction requirements would boost the economic well-being of the construction community in Rwanda.

Proper foot protection is critical to avoid tungiasis. However, many Rwandan people need help to afford appropriate foot protection. Therefore, to create a positive social change in the world, I decided to begin a non-profit organization to obtain used shoes within my community and send them to Rwanda to protect the feet of those at risk. Social change begins with one person, and I want to make the world better when I leave than when I entered.

Conclusions

Cultural barriers must be overcome to educate, train, and modify hygienic behaviors. Learned cultural and sanitary behaviors take time, sometimes years, to transform. The adjustments of behaviors would mollify indoor living conditions and create healthier environments. A shift in the mindset of necessary, basic needs to promote positive health outcomes is essential. Through the knowledge obtained via analytical research, support can be obtained locally and globally to assist Rwandan citizens.

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