HIGHLIGHTS

1. **Cervical Cancer Screening in Developing Countries**

2. **Obesity Epidemiology Profile among High School Students**

3. **Fertility Return after Discontinuing Contraceptive Methods**

4. **Factors Associated with Non-Adherence to Scizophrenia Medications**

Ministry of Health

Rwanda
Biomedical
Centre

Healthy People, Wealthy Nation

Rwanda
Public Health Bulletin

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This will allow more and effective communication between policy makers, researchers and health practitioners.

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Contacts

Email: rwandapublichealtbulletin@gmail.com
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Address

Rwanda Public Health Bulletin Secretariat
KG 203St., City of Kigali, Rwanda

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Dr. Jean Baptiste Mazarati
University of Global Health Equity
Gregorie Muhorakeye
Rwanda Biomedical Centre

Dr. Jean Damascene Iyamuremyi
Rwanda Biomedical Centre
Dr. Jean Nepomuscene Sindikubwabo
Rwanda Biomedical Centre

Marie Fidele Muremba
Rwanda Biomedical Centre
Hassan Mugabo
Rwanda Biomedical Centre

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CONTENT

Dear readers,

It is with pleasure to welcome you to the latest issue of the Rwanda Public Health Bulletin, dedicated to the critical topic of Non-Communicable Diseases (NCDs). NCDs are a global health crisis, and Rwanda is no exception. These diseases, which include cervical cancer, obesity, and chronic kidney diseases, diabetes, cardiovascular diseases, and others are responsible for a significant burden of morbidity and mortality worldwide. NCDs have a profound impact on the lives of our citizens and necessitate dedicated efforts in prevention, early detection, and management.

Cervical cancer is a poignant example of the disparities that exist in healthcare access and outcomes between developed and developing nations. While it remains a leading cause of cancer-related deaths among women in many low-resource settings, this issue of the RPHB sheds light on the feasibility of cervical cancer screening programs tailored to developing countries' specific contexts. The issue provides valuable insights into screening challenges and innovative strategies and approaches to expanding cervical cancer screening and prevention programs, ultimately contributing to a reduction in the burden of this devastating cancer in developing countries.

The alarming rise of obesity, particularly among our high school students, is a concerning trend with far-reaching health implications. Lifestyle choices, dietary habits, and sedentary behaviors have contributed to the surge in obesity rates. This issue explores the epidemiology of obesity among high school students to inform the comprehensive strategies dedicated to promoting healthier lifestyles, improved nutrition, and increased physical activity within schools.

Apart from NCDs highlighted in this issue, you will also learn about factors associated with non-adherence to medications among schizophrenia patients and fertility return among women who discontinue contraception.

The fight against NCDs is a complex and ongoing challenge, but it is one that Rwanda is committed to winning. The knowledge, research, and experiences shared within this issue of the RPHB exemplify the dedication and collaboration of healthcare professionals, researchers, educators, policymakers, and the entire Rwandan community in building a healthier, more resilient Rwanda. Therefore, I sincerely appreciate all the contributors, authors, and the editorial team for their tireless efforts in producing this informative and enlightening issue. May the insights shared here inspire further innovation, research, and action to combat NCDs and enhance the health and well-being of all Rwandans.

Thank you for your continued support in our journey as we strive to create a brighter and healthier future.

Sincerely,

Digitally signed
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Prof. Claude Mambo Muvunyi, MD, PhD
Editor-In-Chief -The Rwanda Public Health Bulltin (RPHB)
Director General- The Rwanda Biomedical Center (RBC)

Feasibility of Cervical Cancer Screening in Developing Countries: Editorial

Samson Habimana[1,*], Theodomir Sebazungu[2], Franklin Valcin[1]

[1]*Atlantic International University, Honululu, USA*
[2]*University of Global Health Equity, Kigali, Rwanda*

INTRODUCTION

*Corresponding author:
Dr. Samson Habimana
Atlantic International University,
Honululu, USA
Email:habimanasam115@gmail.com

Cervical cancer ranks among the leading causes of death worldwide [1]. Cervical cancer remains a significant global health challenge, with 570,000 new cases reported in 2018 and an age-standardized mortality rate of 6.9 per 100,000 [2]. As of 2020, there were approximately 604,000 new cases and 342,000 deaths from cervical cancer globally [3]. The burden of cervical cancer is not evenly distributed, with a disproportionately high incidence and mortality rate in low- and middle-income countries (85-90%) where access to healthcare, including screening and treatment, is limited [4,5]. Inadequate infrastructure, a lack of access to preventive HPV vaccines, screening, and treatment, as well as a shortage of trained professionals and training opportunities in these countries, impede efforts to reduce incidence and death [4]. Apart from deaths, cervical cancer can profoundly impact women's lives, leading to physical and emotional suffering and negatively affecting families and communities.

The primary cause of cervical cancer is persistent infection with high-risk types of Human Papillomavirus (HPV), mainly HPV-16 and HPV-18 [6,7]. HPV is highly contagious and can be transmitted through skin-to-skin contact, including sexual intercourse [7]. It can also be passed from mother to child during childbirth. Other factors associated with an increased risk of cervical cancer include early sexual initiation, multiple sexual partners, smoking, a weakened immune system, and a family history of cervical cancer [8].

For primary prevention, HPV vaccines, such as Gardasil 9 and Cervarix, effective against the most common cancer-causing HPV types, are typically administered to adolescents before they become sexually active, providing long-lasting protection [9]. The use of condoms during sexual activity can also reduce the risk of HPV transmission and other sexually transmitted infections (STIs) [9,10]. However, condoms do not provide complete protection since HPV can infect areas not covered by condoms. In addition, education about safe sexual behavior, avoiding multiple sexual partners, and a healthy lifestyle lead to decreased risk of HPV infection and cervical cancer [11].

Screening is the most effective secondary prevention method to detect precancerous changes early, allowing for timely intervention and preventing the progression of precancerous lesions to cervical cancer [12–14]. Cervical cancer screening is performed using different tests, including Pap Smear (Cervical Cytology), which detects precancerous lesions. HPV testing is another test that can be used alone or in conjunction with Pap smears to identify high-risk

HPV strains in cervical cells [12]. Additionally, Aptima HPV assay is a recent test used to detect specific RNA sequences of high-risk HPV types, and it is sensitive in detecting pre- and cancer cells [15].

Visual Inspection with Acetic Acid (VIA) is a low-cost visual inspection method that involves applying acetic acid to the cervix and looking for color changes that indicate abnormalities [16,17]. They are often used in resource-limited settings, and there is compelling evidence that cervical cancer screening with VIA, which happens to be the most cost-effective option when performed by public health workers, has been effective in lowering cervical cancer mortality rates in resource-limited settings [18].

If minor abnormalities, such as low-grade squamous intraepithelial lesions (LSIL) or low-risk HPV, are detected, close monitoring with repeat testing may be recommended, as these often resolve on their own [7,19]. However, if abnormalities persist, a colposcopy (visualization of the cervix with a special microscope) and biopsy may be performed to confirm the presence of precancerous or cancerous cells. This is followed by the treatment of precancerous lesions using various treatment modalities, such as cryotherapy, laser therapy, or surgical procedures (conization) to remove or destroy abnormal cells before they become cancerous [13,16].

Cervical Cancer Screening Challenges in Developing Countries

In many developing countries, organized cervical cancer screening programs are non-existent, with VIA being the only available option at primary healthcare levels. In some settings in these countries, Pap smears and HPV DNA testing are only accessible to a limited extent. Moreover, awareness levels are alarmingly low, contributing to reduced uptake of cervical cancer screening. Competing public health priorities such as maternal mortality, HIV-related deaths, and women's education can divert attention and resources away from cervical cancer screening in addition to inadequate health-seeking behavior among the population, reducing attendance rates for cervical cancer screening [20]. Furthermore, some aspects of cervical cancer screening, like cytology, still face challenges, including the unavailability of trained staff for interpreting cytology specimens and performing office procedures like Loop Electrosurgical Excision Procedure (LEEP) and cryotherapy [17,20]. Most screening procedures are performed at primary and secondary hospitals, and transportation barriers hinder access to comprehensive cervical cancer screening services for some women in remote areas [20]. These cervical cancer screening procedures include Pap smears, HPV testing, and visual inspections like VIA [21,22]. Referrals to tertiary hospitals occur when abnormalities are detected, where advanced diagnostic tests, colposcopy, and treatments are available. Thus, transportation and economic constraints hinder the care progress for women in remote areas who cannot easily reach tertiary health facilities [20].

In certain countries, a "test and treat" strategy for cervical cancer is implemented, where cervical precancerous lesions are promptly treated with cryotherapy or conization, depending on the lesion type. However, in some regions, cultural factors, like consulting traditional healers, fear of results, and the fear of societal and marital rejection in case of a cervical cancer diagnosis, deter women from seeking screening [23]. Certain minority groups, such as South Asian populations, exhibit lower attendance to cervical cancer screening services than the general population, indicating that particular cultural factors might be involved [2]. Additionally, the shortage of healthcare providers trained in cervical cancer care and limited access to screening services pose substantial challenges [24]. This challenge is particularly prevalent in low-resource regions in developing countries, where limited access to screening and early detection often leads to delayed diagnoses and poorer outcomes. Insufficient capacity for cervical cancer surgery and palliative care, coupled with increased workloads for existing healthcare professionals, can lead to burnout and reduced quality of care [25]. Moreover, health disparities are exacerbated as underserved populations and rural areas in developing countries face greater difficulties in accessing cervical cancer care [26].

Approaches for enhancing cervical cancer screening

Nevertheless, there are promising opportunities and feasible approaches to enhance cervical cancer screening, including the use of telephone short message service (SMS) reminders and engaging

community health workers in sensitizing the population to attend cervical cancer screening have been demonstrated effective [2,24]. In South Africa, Moodley et al. [27] reported that SMS reminders for cervical cancer follow-up appointments were reported effective. Most participants (72%) desired to receive Pap smear results through SMS, and convenience, cost and time savings, and the benefit of saving time off work were all reasons for interest reported. Healthcare providers also stated that the SMS system would be more convenient for women and use resources more efficiently [27]. Furthermore, smartphone-based VIA enables cervical image preservation for patient education, health promotion, record-keeping, follow-up care, remote expert support, and quality control, improving VIA reliability and reproducibility while reducing hospital misdiagnoses and workload [13]. The presence of a family member or neighbor who has experience with cervical cancer or recommendations from community health workers can also encourage women to undergo screening [23]. In the United States of America (USA), the Boston Health Care for the Homeless program, which significantly increased cervical cancer screening rates among homeless women through a multifaceted approach focusing on shifting from scheduled appointments to patient-centric techniques, has also proven effective in screening [26]. This indicates that adapted interventions targeting specific populations have effectively increased cervical cancer screening rates [28,29]. Addressing the shortage of trained healthcare professionals necessitates expanding training programs, enhancing healthcare infrastructure, adopting telemedicine solutions, and increasing public health campaigns. Collaborative efforts and global partnerships are also crucial to combat cervical cancer effectively and improve outcomes

for women worldwide. Strengthening primary healthcare is crucial to broadening access to screening and early interventions. This includes equipping primary healthcare facilities with the necessary infrastructures to perform advanced cervical cancer screening procedures and follow-up for patients with both precancerous legions and malignant legions [30]. In Rwanda, Muhimpundu et al. [30] reported that Rwanda's Screen, Notify, See, and Treat program, implemented in 2013, effectively utilized Rwanda's existing primary healthcare delivery systems and networks of community health workers and was effective in cervical cancer prevention by detecting HPV among 11.6% of screened patients, of whom, 89% underwent VIA discovering cancer legions in 26.2%. These patients with cancerous legions underwent treatment procedures, including hysterectomy, cryoablation, and biopsy [30].

In conclusion, addressing the low attendance in cervical cancer screening programs is critical, especially in developing countries. Feasible approaches include SMS reminders, targeted and culturally adapted interventions, training care providers, strengthening healthcare facilities, and engaging the community. Ministries of health and healthcare facilities, both public and private, should leverage these approaches to increase attendance and adherence to cervical cancer screening, ultimately contributing to the reduction of cervical cancer-related morbidity and mortality. Comprehensive strategies that include vaccination, screening, and education are vital in reducing the burden of cervical cancer and improving women's health worldwide. Increasing access to healthcare services and raising awareness about cervical cancer prevention are essential steps in addressing this disease's impact in the developing world.

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Overweight/Obesity: Prevalence and Epidemiological Profile among High School Students in the District of Bamako

Mamadou Saïdou Bah[1,*], Lebem Togtoga[1], Abdourahmane Ndong[1], Papa Djibril Ndoye[1], Khadim Niang[1], Papa Ndiaye[1]

[1]Department of Public Health and Social Medicine, Faculty of Health Sciences, Gaston Berger University of Saint-Louis, Senegal

ABSTRACT

*Corresponding author:
Mamadou Saïdou Bah
Department of Public Health and Social Medicine, Faculty of Health Sciences, Gaston Berger University of Saint-Louis, Senegal
Email: ba.mamadou-saidou@ugb.edu.sn

Introduction: Overweight/obesity constitutes, for non-communicable diseases, a fertile ground that must be fought at all costs. So, this study aimed to describe and document the prevalence of overweight/obesity among high school students in Bamako, based on socioeconomic and demographic characteristics.

Methods: The study was cross-sectional and descriptive. The sample size was calculated using the StatCalc program of the Epi 7.2 software. Data was collected using a questionnaire on KoboCollect. Nutritional status was assessed using the World Health Organization (WHO)-AnthroPlus software and analyzed with SPSS 26 software.

Results: Among 2,400 high school students surveyed, the prevalence of excess adiposity (overweight + obesity) was 17.4% (n=418). High school students were mostly older than 17 years (61.5%). The mean BMI was 21.1 kg/m^2 ± 4.2. Nutritional status differentiated normal BMI (55.3%), thinness (27.3%), overweight (12.0%), and obesity (5.4%). Charcoal was the predominant energy source (76.1%) used for cooking. Regarding sleep quality, 86.6% of students slept less than 8 hours a day. Past tobacco use was reported by 18.1% of high school students, and 8.4% currently used tobacco products. Additionally, 87.8% of students consumed energy drinks. Approximately 86.1% of the overweight/obese students skipped meals. Overweight/obesity was higher in girls (72.7%), students from private high schools (79.4%), and those who did not practice physical activity (88.3%).

Conclusion: The high prevalence (17.4%) of overweight/obesity calls for guidelines for the promotion of good dietary practices among high school students in the district of Bamako.

INTRODUCTION

Excess adiposity (overweight or obesity) has become a serious public health problem worldwide, affecting adults, children, and adolescents. The etiology of this excess adiposity is multifactorial and complex [1]. According to the World Obesity Atlas, the global prevalence of adolescent obesity was 7% in 2022. Three percent of adolescents aged 10-19 are obese in Sub-Saharan Africa, which is going through a nutrition transition characterized by an increasing incidence of excess adiposity and non-communicable diseases [2]. Excess adiposity in adolescents can lead to short and long-term health problems, such as type 2 diabetes, cardiovascular disease, and high blood pressure [3].

The nutritional transition, characterized by profound changes in dietary habits (excess sugar, salt, and saturated fats) with a decrease in daily physical activity, is rapidly increasing in low- and middle-income countries [4]. These changes are associated with obesity and rapidly increase non-communicable diseases (diabetes, cardiovascular diseases, and cancer). In developing countries, urban poor households spend about 70% of their economic resources on food, resulting in a modification of food distribution circuits, with a transition of markets where ultra-processed foods occupy an important place [5].

Adolescence (10-19 years old) is a stage of rapid growth [6] affected by the nutritional transition with the promotion of ultra-processed and fast food [7]. Teenagers are influenced in their food choices by advertisements that promote fast-food-type products [8], through television, the Internet, and cinema [9]. These various factors contribute to the creation of an environment that promotes obesity (obesogenic environment) [1].

In Mali, the epidemiological profile of overweight/obesity among high school students in the Bamako district is insufficiently documented. It is therefore important to have up-to-date data on overweight/obesity to better guide its preventive and curative management. Thus, this study aimed to assess overweight/obesity prevalence and epidemiological profile among high school students of the district of Bamako.

METHODS

Study design: This was a descriptive, cross-sectional study of public and private high school students, conducted from June 15 to July 4, 2022, in the district of Bamako, the capital of Mali. Bamako City is divided into two banks (Left and Right) by the Niger River, with two corresponding teaching academies controling high schools in the city [10]. Furthermore, the district of Bamako is divided into six (6) communes (I, II, III, IV, V, and VI).

Sample size and procedure: The sample size was calculated using the StatCalc program of the Epi 7.2 software with four parameters: the size of the target population, margin of error of 2%, expected prevalence of 50%, and confidence of 95%, resulting in 2,360 rounded up to 2,400 students.

A multistage stratified sampling technique was employed to select participants. First, using the function (alea) of Microsoft Office Excel, 80 high schools were randomly selected (40 in each academy). Then, in each high school, three classes were selected by a simple random sampling. Finally, in each class, 10 students were selected randomly, stratified according to gender (54% boys and 46% girls).

The criteria for inclusion were threefold: being aged between 10 and 19 years, being enrolled in one of the selected high schools, having agreed to participate in the survey or consent from parents or legal guardians for minors. The sole criterion for non-inclusion was absence on the day of the survey.

Data collection tools and procedure: Anthropometrics used a SECA-type electronic scale to measure weight to the nearest 0.1 kg and a UNICEF-type height rod to measure height to the nearest 0.1 cm. Weight was assessed with light clothing and bare feet on the scale, and height was measured while standing and without shoes.

The KoboCollect app was used to collect the information, and a questionnaire was developed in XLSForm and hosted by the KoboToolbox humanitarian server to facilitate the monitoring of submissions and also to control the reliability of the data collected in real time.

The questionnaire included questions collecting data in five parts: (1) identification of schools (academy and status of high school) and students (age, sex, education level); (2) socio-economic and demographic characteristics; (3) eating habits; (4) physical activity and sedentary leisure; and (5) family history of non-communicable diseases.

Before data collection, 10 interviewers (5 women and 5 men) were selected and trained on the various tools. These investigators were general practitioners and nutrition students with experience in anthropometric and nutritional surveys, as well as a good geographical knowledge of the neighborhoods of Bamako. The two-day training covered the study's objectives, the administration of the questionnaire, anthropometric techniques, and ethical aspects. After the training, a pre-test phase of the questionnaire was conducted, allowing some corrections and clarification of questions.

Data analysis: SPSS version 26 software (IBM, Armonk, New York, USA) was used for cleaning

and analysis.

The World Health Organization (WHO)-AnthroPlus software was used to determine the nutritional status of adolescents through various parameters such as body mass index (BMI), age and sex [11]. The variable of interest in this context pertains to overweight/obesity, which refers to the state where a person has excess adiposity (overweight and obesity). Quantitative variables were presented as mean ± standard deviation, median, and range; qualitative variables were expressed in absolute and relative frequencies.

Ethical considerations: The research protocol was validated by the ethics committee of the University of Sciences, Techniques and Technologies of Bamako (USTTB) (N°2022/127/CE/USTTB). Letters of authorization were issued by the teaching academies of Bamako to allow the investigators access to the selected establishments. The high school students were informed of the objectives and purpose of the research before their selection. The following were obtained: consent for adults and assent, as well as the consent of parents or legal guardians for minors. To guarantee confidentiality, no personal data has been collected.

RESULTS

Sociodemographic profile: The 418 Overweight/ obese high school students were predominantly in

Table 1: *Sociodemographic profile of overweight/obese high school students (n=418)*

| Variables studied | Terms | | | |
| | Yes | | No | |
	n	(%)	n	(%)
Age ≥ 17 years	254	(60.8)	164	(39.2)
Gender = Girl	304	(72.7)	114	(27.3)
Commune V	108	(25.8)	310	(74.2)
Marital Status = Married	14	(3.4)	404	(96.6)
Lives with parent/guardian/marital home	395	(94.5)	23	(5.5)
Father/guardian Professional status= Employee	196	(46.9)	222	(53.1)
Mother/guardian professional status=Employee	141	(33.7)	277	(66.3)
Number of persons in the house/apartment ≥ 5	381	(91.1)	37	(8.9)
Type of household = Mono/polygamous	315	(75.4)	103	(24.6)
Internet subscription	227	(54.3)	191	(45.7)
Energy cooking = Charcoal/firewood/Gas,	318	(76.1)	100	(23.9)
Computer or tablet	134	(32.1)	284	(67.9)
Smartphone ownership	377	(90.2)	41	(9.8)

Table 2: *Anthropometric parameters and nutritional status of high school students (n=2400)*

| Variables studied | | Terms |
	n	Mean ± SD
Anthropometric parameters		
Weight		59.9 ± 13.0 kg
Height		1.68 ± 0.1 m
BMI		21.1± 4.2 kg/m^2
Nutritional status	**n**	**%**
Thinness	655	(27.3)
Normal BMI	1327	(55.3)
Overweight	288	(12)
Obesity	130	(5.4)

private high schools (79.4%), girls (72.7%), single (96.6%), and under cover of a parent (94.5%). Parents were predominantly self-employed for both fathers (53.1%) and mothers (66.3%). Age, variable from 14 to 19 years, with a mean of 16.9 years ± 1.4, and a median of 17 years, was over 17 years for 60.8% of them. These high school students were predominantly in a family of at least 5 people (91.1%), in a monogamous household (75.4%), with an internet subscription (54.3%), did not own a computer or tablet (67.9 %) but owned a mobile phone (90.2%), and used charcoal as their primary energy source (76.1%) (Table 1).

Prevalence: A total of 2,400 high school students were surveyed. The weight ranged from 30.2 to 132.4kg, with a mean of 59.9 (± 13.0) kg and a median of 57.8 kg. Height ranged from 1.30 to 1.96 m, with a mean of 1.68 (± 0.1) m and a median of 1.67 m. The BMI ranged from 12.1 to 43.8 kg/m^2 with a mean of 21.1(± 4.2) kg/m^2, and a median of 20.2 kg/m^2. The nutritional status differentiated thinness for 655 (27.3%). Over a half (n=1327; 55.3%) had normal BMI, 288 (12%) were overweight, and 130 (5.4%) had obesity, totaling 418 (17.4%) for excess adiposity (Table 2).

Table 3: *Eating and substance use habits of overweight/obese high school students (n= 418)*

Variables studied	Terms			
	Yes		No	
	n	(%)	n	(%)
Eating habits				
Addition of sugar	325	(77.8)	93	(22.2)
Resalting of food	307	(73.4)	111	(26.6)
Snacking	378	(90.4)	40	(9.6)
Meal skipping	360	(86.1)	58	(13.9)
Meal rich in fat	373	(89.2)	45	(10.8)
Consumption of energy drinks	367	(87.8)	51	(12.2)
Tobacco, alcohol and other psychotropic drugs				
Tobacco experience (cigarette)	76	(18.1)	342	(81.9)
Current smoking	35	(8.4)	383	(91.6)
Starting age < 16 years	61	(81.3)	14	(18.7)
Number of cigarettes per day > 2	7	(20.0)	28	(80.0)
Wish to quit	31	(7.4)	387	(92.6)
Alcohol experience	5	(1.2)	413	(98.8)
Current alcoholism	3	(0.7)	415	(99.3)
Age of onset of alcoholism < 17 years	2	(40)	3	(60)
Frequency > 1time/month	2	(0.5)	416	(99.5)
Cannabis Experience	9	(2.2)	409	(97.8)
Current cannabis use	2	(0.5)	416	(99.5)
Cannabis start age < 17 years	5	(55.6)	4	(44.4)
Shisha experience	276	(66.0)	142	(34)
Current shisha consumption	142	(34.0)	274	(66.0)
Other psychotropic products (purple drank)	116	(27.8)	302	(72.2)
Factors contributing to eating and substance use habits				
Family smoking	150	(35.9)	268	(64.1)
Advertising messages	247	(59.1)	171	(49.1)
Awareness messages	60	(14.4)	358	(85.6)
Advertising Influence/Teenagers	369	(88.3)	49	(11.7)

Table 4: *Sleep of overweight/obese high school students (n= 418)*

Variables studied	Terms			
	Yes		No	
	n	(%)	n	(%)
Sleep time per day < 8 hours	362	(86.6)	56	(13.4)
Sleeping troubles	295	(70.6)	123	(29.4)
Sleeping troubles > 3 times per week	143	(34.2)	275	(65.8)
Time in bed before sleep > 30 minutes	300	(71.8)	118	(28.2)
The feeling of having slept badly	249	(59.6)	169	(40.4)
Snoring or difficulty breathing	206	(49.3)	212	(50.7)
Absence from school	63	(15.1)	355	(84.9)
To sleep in class	165	(39.5)	253	(60.5)

Eating habits: The predominant bad dietary practices were of 6 orders: snacking between meals (90.4%), excess of oil in the meal (89.2%), consumption of energy drinks (87.8%), skipping meals (86.1%), adding sugar (77.8%) and resalting food (73.4%) (Table 3).

Consumption of tobacco, alcohol, and other psychotropic drugs: Past tobacco consumption experience was reported by 18.1% of high school students, and 8.4% of them were still smoking. For most, smoking started at the age of 16 (81.3%), with less than three cigarettes a day (80%) and without wishing to stop (92.6%).

Alcohol consumption, experienced by 1.2% of the 418 overweight/obese high school students, was predominantly in private high schools (79.4%). Alcohol consumption began before the age of 17 for 40% and was current for 0.7% of them, with a frequency greater than once a month in 0.5%.

Cannabis consumption, experienced by 2.2% of high school students in the past, was started before the age of 17 for 55.6% and was current for 0.5% of them.

The consumption of Chicha, was experienced by

Table 5: *Physical activity and sedentary of overweight/obese high school students (n= 418*

Variables studied	Terms			
	Yes		No	
	n	(%)	n	(%)
Way to get to school = Motorbike	145	(34.7)	273	(65.3)
Travel time >= 10 minutes	383	(91.6)	35	(8.4)
Practice of physical activity at school	378	(90.4)	40	(9.6)
Practice of physical activity outside of school	49	(11.7)	369	(88.3)
Type of sport/physical activity = Walking	184	(44.0)	234	(56.0)
Frequency per week >= 3	75	(17.9)	343	(82.1)
An environment conducive to physical activity	227	(54.3)	191	(45.7)
Disability / physical activity	79	(18.9)	339	(81.1)
Television: duration > 2 hours on school days	130	(31.1)	288	(68.9)
Television: duration > 2 hours on weekends	339	(81.1)	79	(18.9)
Television/Computer/Tablet > 3 days/week	284	(67.9)	134	(32.1)
Social media/use	367	(87.8)	51	(12.2)
Social media/duration> 2 hours per day	272	(74.1)	95	(25.9)
Video games/habits	191	(45.7)	227	(54.3)
Video games/duration> 1 hour per day	61	(31.9)	130	(68.1)

Table 6: *Psychosocial conditions and family history of diseases of overweight/obese high school students (n=418)*

Variables studied	Terms			
	Yes		No	
	n	**(%)**	**n**	**(%)**
Psychosocial conditions				
Peer influence	204	(48.8)	214	(51.2)
Influenced by family	204	(48.8)	214	(51.2)
Likeness Image = 6	97	(23.2)	321	(77.8)
The image we want to look like = 4	269	(64.4)	149	(35.6)
Ashamed of his current corpulence	280	(67.0)	138	(33.0)
Mockery/stigma overweight	345	(82.5)	73	(17.5)
History of diseases in the family				
Diabetes	246	(58.9)	172	(41.1)
High blood pressure	231	(55.3)	187	(44.7)
sickle cell disease	21	(5.0)	397	(95.0)
Asthma	116	(27.8)	302	(72.2)
Other allergies	85	(20.3)	333	(79.7)

66% in the past of high school students and was current for 34% of them.

Additionally, the following factors were: the influence of advertising (88.3%), advertising messages (59.1%), family smoking (35.9%), the consumption of other psychotropic products (27.8%) and awareness messages (14.4%) (Table 3).

Sleep quality: The mean sleep time for high school students was 6.9 ± 1.0 hours. The median sleep time was 7 hours. Regarding sleep quality, 86.6% of students slept less than 8 hours a day (Table 4).

Physical activity and sedentary lifestyle: The practice of physical activity was very low among girls (5.1%) compared to boys. However, 88.3% (n=369) of overweight/obese high school students did not practice physical activity outside the compulsory physical education and sports sessions at school. Among overweight/obese high school students, 32.1% had a computer or tablet. For internet usage, 87.8% of high school students used social media such as WhatsApp, Facebook, and TikTok (Table 5).

Psychosocial conditions: Among the overweight/obese high school students, 82.5% had experienced stigma because of their corpulence. Regarding their physical appearance, 67.0% of them were ashamed of their current build; the 4/9 image represented 64.4% of the physical appearance desired by high school students (Table 6).

History of diseases in the families: The histories of diseases found in the families of overweight/obese high school students were respectively 58.9% for diabetes, 55.0% for high blood pressure, 27.8% for asthma, 20.3% for allergies, and 5.0% for sickle cell disease (Table 6).

DISCUSSION

This study aimed to describe the epidemiological profile of overweight/obesity among high school students in the District of Bamako.

The findings showed that the average age of high school students was 16.9 years. Comparable results (16.8 years) were also observed among high school students in the city of Sfax in Tunisia [12]. This trend could be attributed to the particular characteristics of the age group of 15 to 19 years, which constitutes the second phase of adolescence [13], and is marked by significant physiological and behavioral changes. Overweight/obesity was higher among girls (72.7%), which could be explained by the fact that boys are less sedentary than girls. High school students in private schools (79.4%) were more overweight/obese than those in public schools. The results of the study conducted

by Mwaikambo et al. [14], in Tanzania were similar (75.9%) to those in this study. This could be explained by the fact that private high schools have more ultra-processed food outlets, and the socioeconomic level is generally higher compared to public high schools. High socioeconomic status can influence the dietary habits of individuals or households, often leading to diets high in fat, salt, and sugar while being low in fruits and vegetables. This dietary imbalance could influence the body mass index and lead to excess adiposity [15]. Studies conducted in Congo-Brazzaville by Mabiala-Babela et al. [16], and in Nigeria by Ubesie et al. [17] revealed that obesity was more common among adolescents from households with high socioeconomic status. Unlike developed countries, individuals or households of high socioeconomic status are more exposed to ultra-processed foods in developing countries, where the consumption of Western-style foods is considered a sign of wealth and well-being within these societies.

This study also revealed that 87.8% of overweight/obese high school students consumed energy drinks. These beverages contain significant amounts of sugar and caffeine, which are associated with negative health consequences. Excess sugar found in energy drinks is a risk factor associated with overweight/obesity [18], while the caffeine included in these drinks can lead to dependence among consumers, with marketing campaigns and advertising potentially exacerbating the issue. Brands of soda and energy drinks particularly target the adolescent population through recreational activities in schools or within the community. In addition, the consumption of energy drinks could increase alcohol dependence in adolescents. This trend could be explained by adolescents mixing energy drinks and alcohol to combine the stimulating and relaxing or euphoric effects [19].

We found that snacking rate was very high among overweight high school students (90.4%), which is higher than what was reported in another study conducted by Barry et al. [20], among high school students from Kamsar in Guinea (24%). This disparity could be explained by the specific context in which each study was conducted. The present study was carried out in an urban environment, while that of Barry et al. was conducted in a peri-urban environment, where environmental factors and dietary habits may vary between these two

contexts. Snacking is generally associated with the consumption of ultra-processed foods such as cakes, candies, cookies, sodas, and chips [21]. The nature and habits of snacking can significantly impact health and well-being through all stages of life due to the associated high risk of overweight/obesity [22]. Each individual's level of physical activity depends on various parameters related to their personal characteristics, environment, and social culture. According to the WHO, more than 80% of adolescents in school do not meet the global recommendations on physical activity. Similarly, 88.3% of overweight/obese high school students in our study did not practice physical activity outside physical education and sports sessions at school. Compared to this study, the results reported by Regaieg et al. [12], were higher (99.0%) among overweight/obese high school students (n=400). This decline in physical activity among adolescents could be explained by spending more on screens (television, internet, video games), but also by a weak promotion of physical activity outside dedicated school training sessions, lack of physical education and sports at school. This calls for the establishment of non-sedentary recreational facilities in various communities designed to encourage physical activity and be accessible to children and adolescents in Mali, especially girls. Without immediate action, the achievement of the global goal to reduce the inadequacy of physical activity to 15% by 2030 could be jeopardized [23]. The practice of regular physical activity could reduce the risk of early mortality by 30 to 60%. In addition, it also helps reduce depression and anxiety [24]. This practice also promotes a better quality of sleep and can help reduce the consumption of unhealthy foods and snacking in children and adolescents [24].

Adolescence is characterized by disruptions in sleep structure that have cognitive, psychological, and metabolic consequences [25]. Sleep quality is influenced by various factors, including diet, environment, physical activity, and genetics [26]. In this study, sleep was disturbed in 70.6% of overweight/obese high school students. These disturbances could be attributed to sedentary hobbies such as watching television, using social media, and playing video games. These behaviors increase the consumption of unhealthy foods and lead to a reduction in energy expenditure. The consumption of energy drinks, with high levels

of caffeine reported by participants could indicate sleep disorders/disturbances. A meta-analysis by St-Onge et al. [27], found an association between sleep disorders and the consumption of energy drinks and the onset and progression of cardiovascular diseases, metabolic diseases, broncho-respiratory diseases, cancers, asthma, and depression.

Addictive behavior is a public health problem at all stages of life, particularly among adolescents. Tobacco and alcohol are important risk factors for non-communicable diseases [28]. These two major risk factors for non-communicable diseases raise concerns about the health and well-being of high school students in the short and long term. In this study, the prevalence of current smoking among overweight/obese high school students was 8.4%. In addition, smoking in the family environment was found in 35.9% of overweight high school students. The coexistence of overweight/obesity, active smoking and smoking within the family could pose a threat to the health of high school students [29]. This is why it would be important to integrate education items of certain risk factors for non-communicable diseases, such as smoking, into awareness programs on overweight/obesity in schools.

In this study, 82.5% of overweight/obese high school students had experienced stigma. Weight stigma is a phenomenon of devaluation experienced by excess adiposity individuals, both in society, within the family and at school [8]. It is the fourth most common form of stigma, after discrimination based on race, gender, and age [30]. Overweight or obese individuals also encounter cybernetic discrimination through social media. This type of discrimination can cause overweight or obese adolescents to experience depression, low self-esteem, and social isolation, potentially leading to increased food intake and snacking [31]. Moreover, 67.0% of them were ashamed of their current body size/image. This situation could also make it difficult to manage overweight or obesity since most of these people are ashamed to engage in physical activity due to the way peer groups or society view their body weight. In addition, the risk of mortality is higher among people who have been stigmatized [31].
Obesity is a risk factor associated with metabolic diseases (type 2 diabetes) and cardiovascular

diseases (high blood pressure) [8]. Apart from metabolic and cardiovascular complications, obesity is also associated with respiratory complications such as asthma [32]. Type 2 diabetes accounts for over 90% of diabetes cases [33]. In this study, diabetes was found in 58.9% of the families of overweight/obese high school students. In a previous study conducted by Barry et al. [20], in Guinea, the prevalence of a family history of diabetes was lower (41%) compared to the results obtained in this study. This disparity could be explained by the fact that the study by Barry et al. [20] was carried out in a peri-urban environment, unlike this study, which was carried out in a large city, with a larger sample. Genetic, behavioral, and environmental factors could explain this pattern between overweight/obesity and a family history of diabetes. Genetic factors are important in predisposing to overweight/obesity and diabetes [34]. Parents' eating and lifestyle habits may also influence those of their children. Environmental influences occur throughout development, beginning at conception, continuing through the growth period, and continuing into adulthood [35]. Including the home environment in the design of programs to combat overweight/obesity in children and adolescents could benefit both in the short and long term period [36].

As limitations, this study did not include the assessment of the quantity (portions) of food consumed. Information regarding parental overweight or obesity was also not collected. The descriptive design limited our study, especially in determining causation and control over variables, as we reported what we found only. Therefore, extensive longitudinal analytic studies involving all schools in Mali, and also including parental overweight/obesity and food portion details, are recommended to mitigate these limitations.

CONCLUSION

This study showed that overweight/obesity was higher among girls and private high school students. Several unhealthy behaviors, such as snacking, energy drink consumption, eating in front of screens, and physical inactivity outside of school, were observed among overweight/obese high school students. To reduce overweight among high school students, it is recommended that parents adopt good eating habits at home and

integrate nutritional education into their children's education. High school students should also limit their consumption of sugary drinks and fast foods while reducing their time spent watching television, video games and surfing the Internet. It is essential that the Ministries of Health and National Education promote good dietary practices and encourage the daily practice of physical and sporting activities in schools. Since there are significant links between overweight/obesity and metabolic and cardiovascular complications in adulthood, prevention during adolescence represents an important window of opportunity for public health officials.

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Return to Fertility after Discontinuation of Modern Contraceptive Methods in Rwanda

Muzungu Hirwa Sylvain[1,*], Rwema Valens[1]

[1]*African Centre of Excellence in Data Science, University of Rwanda, Kigali, Rwanda*

*Corresponding author:
Dr. Muzungu Hirwa Sylvain
African Centre of Excellence
in Data Science, University of
Rwanda, Kigali, Rwanda
Email: Sylvain.hirwa@yahoo.com

ABSTRACT

Introduction: Return to fertility after discontinuing modern contraceptives is a concern for women. The absence of local evidence on this important issue contributes to rumors and myths associating family planning with infertility. This research aims to study the time it took a woman to get pregnant after discontinuing a method in Rwanda.

Methods: This study uses data collected from Rwanda Demographic and Health Survey 2020. Data cleaning was conducted, and appropriate sample weights were applied. Statistical analysis was conducted using the Cox proportional hazard model.

Results: Twelve-month pregnancy probability was 94% for women who used barriers and traditional methods, 92% for IUDs, 88% for pills, 83% for implants, and 81% for women who used injections. The age of women and the number of children were associated with the time to return to fertility (HR=0.95, CI: 0.94-95, P<0.0001, and HR=1.15, 95CI: 1.09-1.2, p< 0.0001, respectively). The duration of contraceptive use and body mass index were not associated with the time to return of fertility.

Conclusion: This research revealed a strong association between the type of contraceptive method and the time until fertility returns.

INTRODUCTION

Modern contraceptive methods have contributed to more than 30% reduction in maternal mortality in developing countries. Additionally, family planning contributes enormously to women's empowerment, poverty reduction, and environmental sustainability [1]. Over the past few decades, Rwanda has worked to ensure access to sexual and reproductive health services. Family planning services are readily accessible free of charge at all levels of Rwanda's health system, including at the community level through community health workers in each village [2–4]. The return of fertility after using reversible contraceptive methods is a concern for women.

Although infertility is a common condition, any delay in returning to fertility in women who use modern contraceptives is linked to their use of contraceptives [5]. Several African studies have reported the belief that modern contraceptive methods can cause infertility [6]. A study conducted in Ethiopia found that one in two women believed that modern contraceptives might cause infertility, and studies found that this misconception is also common in Rwanda [6–8]. Myths and misconceptions related to contraception lead to lower satisfaction, distrust, and reduced use of family planning services [10], and women with such beliefs are more likely to deny family planning [9].

Evidence related to returns on fertility after family

planning varies significantly across regions. A worldwide systematic review estimated that the rate of pregnancy within 12 months after discontinuation of modern contraceptives was 83% [5]. A study that analyzed data from 47 Middle- and Lower-income countries revealed the 12-month probability of pregnancy of 87% for women who used pills, 86% for intrauterine devices, and 80% for women who used both injectables and implants. The twelve-month probability of pregnancy was higher among young women aged < 40 years and lower among women aged ≥ 40 years [10]. A study in Indonesia reported an even lower probability of pregnancy after discontinuation of modern contraceptives, ranging between 72 and 85% for women who discontinued the IUD, 75% and 81% for pills, 64% and 67% for injectables, and 72% and 76% for women who used implants [11].

With such variations in the available evidence, many clinicians and reproductive health professionals struggle to educate and assure women about the return of fertility after contraceptive use. Fertility is a multifaceted process that depends on several factors[5], including demographic factors such as age; obstetric and medical conditions, such as uterine anomalies or hormonal imbalances; and individual lifestyle factors such as obesity, smoking, and frequency of sexual intercourse [12], [13]. In addition, country-specific factors such as demographics, policies, and culture may play a role [14]. These factors vary significantly between regions and countries, highlightng a need to establish evidence specific to Rwanda tailored to the local context. Therefore, this study aimed to study the return on fertility after using modern contraceptives in Rwanda. Using nationally representative Demographic and Health Survey (DHS) data, we aim to establish credible evidence that may assist clinicians, sexual and reproductive health practitioners, and policymakers.

METHODS

This study used data collected from the 2020 Rwanda DHS. Using the official DHS Recorder, data of women who stopped contraceptive methods to become pregnant were selected. The discontinued methods were divided into five groups: Four types of modern contraceptive methods (pills, injectables, implants, and intrauterine devices), an additional group of barriers, and traditional methods. Only married women living with their partners were included. Data on contraceptive use were retrieved from the Calendar Part of DHS Dataset. This information was retrieved using string methods in the Python programming language.

Variables: In this study, the dependent variable was the time of pregnancy after discontinuing the contraceptive method. The shortest time to pregnancy was one month for women who became pregnant immediately in the first month after discontinuation. Women still waiting to become pregnant at the end of the study were right-censored.

Independent variables included age, education level, wealth category, urban or rural location, weight, height, and hemoglobin levels.

Sampling: This study used data retrieved from the Rwanda Demographic and Health Survey 2020. Participants in DHS were selected using a two-stage sample design, and the survey was intended to provide estimates at a national level. In the first stage, 500 clusters were selected using a sampling frame generated from the fourth Rwanda Population and Housing Census. The second stage selected households in each cluster using systematic sampling.

All women participants in DHS who met our inclusion criteria were selected for the analysis. Initially, we included women who reported at least one episode of stopping the contraceptive method due to wanting to become pregnant. In addition, only women who were married and living with their male partners were selected. During analysis, sampling weights were adjusted to obtain national estimates.

Survival Analysis: This study used survival analysis to understand the time to fertility return after modern contraceptives in Rwanda. Survival analysis involves studying time-to-event data. This study examined the time taken to conceive after discontinuation of the contraceptive method, using the Cox Proportional Hazard Model to determine whether the type of contraceptive method used impacts the time it takes for fertility to return. In addition, we examined the association between the age of women, body mass index, hemoglobin, education, wealth, and the time until return on fertility. The Cox proportional hazards model is a

regression model that can be expressed as follows:

$$h(t) = h_0(t) \times \exp(b_1 x_1 + b_2 x_2 + \dots + b_p x_p)$$

Where t is the time, x_i are the covariates, b_i are the coefficients of the covariates. h(t) is the hazard at that time, t. $h_0(t)$ is the baseline hazard. This is a hazard value when all covariates are equal to zero. The hazard ratio (HR) is an important measurement in the interpretation of the Cox Model, which measures the relative risk of experiencing an event between the two groups. If the hazard ratio is greater than one, an increase in the value of the covariate increases the hazard of an event.

$$Hazard\ ratio\ = \frac{h_k(t)}{h_{k'}(t)} = \frac{h_0(t)e^{\sum_{i=1}^{n} \beta x}}{h_0(t)e^{\sum_{i=1}^{n} \beta x'}} = \frac{e^{\sum_{i=1}^{n} \beta x}}{e^{\sum_{i=1}^{n} \beta x'}}$$

Ethical considerations: Data used in this study were obtained from publicly available DHS Dataset. The 2020 Rwanda Demographic and Health Survey protocol was reviewed and approved by the Rwanda National Ethics Committee. Witten authorization to access and use data was obtained from the DHS Program. All dataset were anonymized and de-identified. No personal identifiable was accessed and/or utilized in this research. Data were stored and processed on secure University of Rwanda servers, and only authorized personnel had access to the dataset.

RESULTS

The analysis was conducted on 1117 women data retrieved from the DHS 2020 [17]. The average age was 32. Most women (82%) lived in rural areas and had a primary education level (68%). The average number of children per woman was three. The mean body mass index was 23.8, and the mean duration of contraceptive use was 26 months. On average, it took a woman three months to become pregnant after stopping the contraceptive method. Table 1 provides the detailed descriptive characteristics of the study sample.

Survival Analysis: Initially, the univariate Cox Model was fitted. Women's age, type of contraceptive method, and the number of children were significantly associated with time until the return of fertility (P < 0.05).

Table 2 shows the results of the univariate Cox Model analysis.

Table 1: *Socio-demographic characteristics of the study population*

Characteristics	N = 1,117
Participants' Age	32.0 (28.0, 37.0)[1]
Type of Residence	
Rural	912 (82%)
Urban	205 (18%)
Body Mass Index	23.8 (21.8, 26.4)[1]
Number of Children	3.00 (2.00, 4.00)[1]
High Level of Education	
No Education	97 (8.7%)
Primary	765 (68%)
Secondary	188 (17%)
Higher	68 (6.1%)
Wealth Category	
Poorest	180 (16%)
Poorer	196 (18%)
Middle	259 (23%)
Richer	240 (21%)
Richest	243 (22%)
Time used contraceptive months	26 (15, 38)
Method Stopped	
Barrier & Traditional	221 (20%)
Implants	149 (13%)
Injection	524 (47%)
IUD	31 (2.8%)
Pill	194 (17%)
Time to Pregnancy (Months)	3 (2, 7)

[1]*Median (Interquartile Range)*

Multivariate Cox Model: In addition to significant variables (age, contraceptive method, and number of children) in the multivariate Cox proportional hazard model, we added "Time contraceptive method used" in the multivariate analysis since existing literature associated it with the return to fertility.

Multivariate analysis revealed an increased influence of contraceptive methods on the duration of fertility return. The use of injections was significantly associated with time to return of fertility (HR=0.6, CI: 0.49-0.73, P<0.0001). This indicates that compared to women who used barriers and traditional methods, those who used injections had a 40% increased time until fertility. Similarly, the use of contraceptive implants was also associated with the duration of time to return of fertility (HR= 0.61, CI: 0.48-0.78, P<0.0001).

Table 2: *Univariate Cox Proportional Hazard Analysis of Factors Associated with Time to Fertility Return*

Characteristics	HR	95% CI	P-value
Women Age	0.98	0.97, 0.99	0.001
Number of Children	1.04	1.00, 1.08	0.032
Time contraceptive method used (months)	1.00	1.00, 1.01	0.14
Grouped Contraceptive Method			
Barriers - Traditional (reference)	—	—	—
Implants	0.72	0.58, 0.89	0.003
Injection	0.64	0.54, 0.75	<0.001
IUD	0.81	0.55, 1.21	0.3
Pill	0.73	0.60, 0.89	0.002
Hemoglobin Level	1.00	0.99, 1.02	0.9
Weight	1.00	1.00, 1.00	0.6
Height	1.04	0.88, 1.23	0.6
Highest Education Level			
No Education (reference)	—	—	—
Primary	1.17	0.94, 1.47	0.2
Secondary	1.30	1.00, 1.69	0.047
Higher	1.50	1.09, 2.08	0.014
Wealth Category			
Poorest (reference)	—	—	—
Poorer	1.34	1.08, 1.66	0.007
Middle	1.15	0.95, 1.40	0.2
Richer	1.19	0.97, 1.46	0.092
Richest	1.26	1.03, 1.54	0.023
Place of Residence			
Rural (reference)	—	—	—
Urban	0.90	0.77, 1.04	0.2
Body Mass Index	1.00	0.98, 1.02	0.9

CI: 95% Confidence Interval, HR: Hazard ratio

This indicates that compared to women who used barriers and traditional methods, those who used implants had a 39% increase in time to return to fertility.

The use of Pills was also associated with the duration of time until pregnancy (HR=0.78, CI:0.63-0.98, p=0.033), indicating that compared to women who used barriers and traditional methods, those who used pills had a 22% increase in the time of return to fertility.

The time that a contraceptive method was used had a significant p-value of < 0.01 with a hazard ratio of 1.01. However, the covariate had a very small coefficient of 0.00665, making its contribution insignificant. The age of women was associated with the duration of time to fertility return (HR=0.95, CI: 0.94-95, P<0.0001), indicating that an increase in age was associated with a 5% increase in the time to fertility return. An increase of one child was associated with a 15% reduction in the duration of return to fertility (HR=1.15, 95CI: 1.09-1.2, p< 0.0001).

Pregnancy rate after family planning discontinuation: After 6 months, the pregnancy probability was 83% for women who used barriers and traditional methods, 79% for IUDs, 72% for

Table 3: *Multivariate Cox Model Analysis of Factors Associated with Time to Fertility Return*

	Coefficient	95% CI		HR	Z	P value
Discontinued Implants	-0.49438	0.61	0.48	0.78	-3.90925	0.00009
Discontinued Injections	-0.5133	0.6	0.49	0.73	-4.97262	0.00000
Discontinued IUD	-0.06557	0.94	0.54	1.61	-0.23616	0.81331
Discontinued Pills	-0.24339	0.78	0.63	0.98	-2.12139	0.03389
Women Age	-0.05072	0.95	0.94	0.96	-6.89352	0.00000
Time a Contraceptive Method was used	0.00665	1.01	1	1.01	2.91275	0.00358
Total number of children	0.13551	1.15	1.09	1.2	5.23558	0.00000

CI: 95% Confidence Interval, HR: Hazard ratio, Z: Z-score value

pills, 67% for implants, and 64% for females who used injections.

After 1 year, the pregnancy probability was 94% for women who used barriers and traditional methods, 92% for IUDs, 88% for pills, 83% for implants, and 81% for women who used injections. After 2 years, the pregnancy probability increased to 98% for women who used barriers and traditional methods, 97% for IUDs, 95% for pills, 93% for implants, and 91% for women who used injections.

After three years, the pregnancy probability increased to nearly the same rate: 99.7% for women who used barriers and traditional methods, 99.4 % for IUDs, 98.5% for pills, 97.4% for implants, and 96.5% for women who used injections.

DISCUSSION

This study aimed to determine the time of return to fertility after discontinuation of the modern contraceptive method. In addition, we studied the association between different factors and the time to return to fertility.

This study found that the type of contraceptive method used was strongly associated with the time to fertility return. The time to return to

Table 4: *Pregnancy rate after family planning discontinuation*

Time (months)	Barrier & Traditional*	Implants*	Injections*	Pills*	IUD*
1	0.2692668	0.1781813	0.1659855	0.2046651	0.2439657
2	0.4718963	0.3292659	0.3088522	0.3725236	0.4340147
3	0.6202828	0.4543219	0.4289368	0.5067981	0.5782158
6	0.8297782	0.6696526	0.6410112	0.7254160	0.7937221
12	0.9444036	0.8359489	0.8121076	0.8786779	0.9239300
24	0.9857052	0.9298553	0.9143704	0.9549844	0.9773354
36	0.9970710	0.9739779	0.9657785	0.9858478	0.9944844

*IUD: Intrauterine device, *Rate calculated in percentages by diving by 100*

fertility was higher in women who received injections, followed by Implants and Pills. The time to return to fertility was lower in women who used intrauterine devices, barriers, or traditional methods. This trend was consistent with the results of previous studies [5,15,16].

The twelve-month pregnancy probabilities were 94% for women who used barriers and traditional methods, 92% for IUDs, 88% for pills, 83% for implants, and 81% for women who used injections. These results can be compared with a study that analyzed data from 47 African countries. In that study, 12 months of pregnancy probabilities were 90% for traditional methods, 87% for pills, 86% for IUDs, and 80% for both implants and injections [10].

Low twelve-month pregnancy usage probability for injectables has been documented in previous studies. A study conducted in Ethiopia revealed a 12-month pregnancy rate of 75% for Depo-Provera, a type of contraceptive injection used in Rwanda [16]. A meta-analysis also reported a lower pregnancy rate among injectable and implant users [15]. In many studies, pregnancy rates after IUD use were higher than those after Injectables and Implants [11,15,16]

An association between parity, number of children, and time to return to fertility was also observed in this study. An additional child reduces the time to fertility returns by 15%. This finding is consistent with research on the return on fertility across Africa [17]. The effect of the women's age on the time taken to return to fertility was also observed in this study. An increase in age was associated with a 5% increase in time until fertility returned. This is consistent with previous studies that have documented delayed fertility returns in older women [5,10,15,16].

In this study, the duration of contraceptive use was not significantly associated with an increase or decrease in time to return to fertility. This finding has also been documented in previous meta-analyses [5,15]. Other covariates, such as body mass index, weight, height, hemoglobin levels, education, wealth, and urban residence, were not associated with the time to return to fertility.

There some limitations to consider. This study used data collected from the Rwanda Demographic and Health Survey, a robust, standardized cross-sectional survey. However, the study's retrospective nature and reliance on self-reported information may introduce the potential for recall bias. Women who participated in DHS may not adequately remember the specific timing of contraceptive discontinuation, leading to an imprecise estimate of the time to pregnancy. This limitation could impact the validity and reliability of the findings, especially if the ability to recall varies by sociodemographic factors such as education.

Another limitation of this study lies in grouping contraceptive methods into major categories. All modern methods were categorized into Injections, Pills, Implants, and IUDs. However, each category has different formulation, dosage, and types. In Rwanda, two main types of Implants exist, Jadelle and Implanon, which last five and three years, respectively. Contraceptive pills can also be divided into oral combined pills and progesterone-only pills. The former contains two hormones, estrogen and progesterone. Different types of intrauterine devices also exist. While this simplification may facilitate analysis and interpretation, it may hide important details. An in-depth analysis that examines each singular type of contraceptive method may provide a more comprehensive understanding.

CONCLUSION

Fertility returns differ considerably between contraceptive methods. Injections were associated with delayed fertility return, while the time to return to fertility after an intrauterine device was comparable to that of condoms and traditional methods. An increase in age increases the time of return to fertility, whereas an increase in the number of children reduces the time of return to fertility.

The results of this study provide foundational evidence for return to fertility in Rwanda. There is a need to strengthen family planning counseling to combat myths and misinformation. Healthcare providers should provide personalized family planning education. Return to fertility should be discussed, especially for women above 40 years who want to become pregnant immediately after discontinuing a family planning method.

Data Access Statement: Research data supporting this publication are available from the GitHub

repository at located at https://github.com/hirwa94/fertility-return-in-rwanda

Author Contributions: Muzungu Hirwa Sylvain contributed to the design, implementation analysis

of the results and the writing of the manuscript. Rwema Valens contributed in inception of the research, design and data analysis.

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Factors Associated with Non-adherence to Medication among Patients with Schizophrenia consulting from January to June 2021 at Ndera Neuropsychiatric Hospital

Schadrack Ntirenganya[1,], Samson Habimana[1,*], Janvier Yubahwe[1], Bizoza Rutakayire[1]

[1]*University of Rwanda, Kigali, Rwanda*

*Corresponding author:
Dr. Samson Habimana
University of Rwanda, Kigali,
Rwanda
Email: Email:habimanasam115@
gmail.com

ABSTRACT

Introduction: Non-adherence to medications is a common and complex challenge among patients with schizophrenia, leading to poor outcomes and low quality of life. However, there is a lack of studies to determine factors associated with poor adherence to antipsychotic medications at Ndera Neuropsychiatric Hospital, which is the largest hospital treating mental health disorders in Rwanda.

Methods: This mixed-method study employed a cross-sectional design using a self-administered questionnaire and face-to-face interviews. Descriptive analysis and chi-square test were performed, and SPSS (Version 21) was used to analyze quantitative data. Qualitative data were also analyzed by using thematic method analysis.

Results: Among 343 patients recruited, 26.2% were adherent to antipsychotic medications, 57.2% were partially adherent, and 16.9% were not adherent to medications. Education, residence, employment, and marital status were significantly associated with adherence (p<0.001, p<0.001, p=0.045, and p=0.013, respectively). During interviews, participants reported a lack of understanding of the disease and benefits of the treatment, poor perceptions, fear of treatment side-effects, chronicity of the disease and long-term uptake of medications, financial constraint and lack of social support, religious and cultural beliefs, and poor healthcare provider-patient relationship and communication are factors preventing them from adhering to medications.

Conclusions: This study revealed a high prevalence of non-adherence to prescribed medications among schizophrenia patients, with multiple complex factors contributing to this issue. Addressing these challenges requires a multifaceted approach encompassing education, social and financial support, and raising awareness at the individual and community levels.

INTRODUCTION

Schizophrenia is a chronic mental disorder that profoundly impacts an individual's emotions, thoughts, and behavior. The prevalence among the general population is estimated to be approximately 1% [1,2]. Though adhering to prescribed medications is a vital aspect of patient care, between 30% and 50% of patients do not adhere to their prescribed drug regimens as recommended

by healthcare providers [3,4]. Non-adherence to medication increases the risk of relapse, which results in numerous emergency service admissions, re-hospitalizations, increased costs within the healthcare system, and increased demand for healthcare professionals [5]. Medications play a crucial role in symptom management and overall improvement in individuals with schizophrenia, and factors contributing to medication non-adherence, including lack of knowledge, often lead patients to underestimate the importance of consistent medication use [6]. Medication side effects, such as weight gain and sedation, can deter adherence, as can the complexity of multi-drug regimens. Stigma and social isolation associated with mental illness further impede treatment compliance, as does substance abuse, which frequently co-occurs with schizophrenia [4,7]. Other factors include inadequate family care, negative self-perception, and the duration of illness [8].

Understanding factors associated with non-adherence is crucial for healthcare providers and improving treatment outcomes for individuals with schizophrenia. However, there is a lack of consensus regarding the specific factors contributing to this non-adherence, which may stem from problems related to treatment, the disease itself, or environmental factors [8,9]. No known studies have been conducted to evaluate the prevalence and factors associated with non-adherence to schizophrenia medications at Ndera Neuropsychiatric Hospital, the largest hospital exclusively caring for patients with mental illness in Rwanda. Therefore, this study aimed to determine the prevalence and factors associated with non-adherence to medications among schizophrenia patients treated at Ndera Neuropsychiatric Hospital.

METHODS

Study design and setting: This cross-sectional study used mixed methods (a self-administered questionnaire and face-to-face interviews), and was conducted at Ndera Neuropsychiatric Hospital, Kigali, Rwanda among outpatients consulted from January to June 2021. Ndera Neuropsychiatric Hospital was founded by the Brothers of Charity in 1968 to provide services such as outpatient consultations, admissions, occupational therapy, physiotherapy, clinical psychology, and neurology.

Study population: This study targeted patients diagnosed with schizophrenia who visited the outpatient department for follow-up at Ndera Neuropsychiatric Hospital. Schizophrenia patients aged 18 and above, with the ability to understand relevant information and respond and give informed consent, were included. We excluded patients aged less than 18, those with other diagnoses, and patients unable to effectively communicate, understand, and those unfit to give informed consent.

Sampling: We calculated the sample size using the formula of Lesli Kish, as follows:

$$N = Z^2 \times P \times Q/D^2$$
N: Sample size
Z: Z-score at 95% confidence interval = 1.96
P: Expected prevalence of schizophrenia at Ndera Neuropsychiatric Hospital (66.84%) q: 1-P (Expected non-prevalence): 1-0.6684= 0.3316
D: Relative desired precision (5%) or 0.05
Therefore, our sample size was 341

We selected patients fulfilling the inclusion criteria mentioned above using a purposive sampling method until the targeted sample size was reached.

Data collection procedures: The quantitative data were collected by using a three-part questionnaire. The first part collected socio-demographic data. The second part collected information related to adherence using the Medication Adherence Rating Scale (MARS) [10]. The last part collected information on demographic factors contributing to poor adherence to medication.
We conducted face-to-face interviews, and participants were asked for more details about factors that might cause them not to adhere to prescribed medication
The investigators approached patients after being attended to at the hospital and signed a consent form. The investigators handed over questionnaires to the participants and conducted interviews in a private and comfortable environment.

Data analysis: Qualitative data were transcribed in Kinyarwanda and then translated to English. Collected data were analyzed using two methods. Quantitative data were analyzed using SPSS version 21. Descriptive statistics were used for data summarization, while chi-square was used

to determine the relationship between adherence to prescribed medication and other variables. A P-value of < 0.05 was considered statistically significant. Thematic analysis was performed to analyze qualitative data in order regarding the capacity, opportunity, and motivation model of behavior.

Ethical approval: The Research Ethics Committee of Ndera Neuropsychiatric Hospital and the Institution Review Board of the University of Rwanda, College of Medicine and Health Sciences approved the study.
The questionnaire used was anonymous to ensure confidentiality and interviews were conducted in a private, safe and secure room, and no idendifications of patients were recorded.
The participants were informed the structure of the research and its purpose. Then they were invited to voluntarily participate and had all rights to withdraw at any time.
The data collected were used exclusively for the purpose of the study and no one other than the investigators had access to them.

RESULTS

Demographic characteristics: The study included 343 outpatients diagnosed with schizophrenia and treated at Ndera Neuropsychiatric Hospital. The majority (43.1%) of the participants were under 35 years of age. Almost half (50.7%) of them were males. Most (37.3) participants attended at most primary school. Most were unemployed (57.4%). Most (51.0%) participants were from urban regions, and were Protestants (42.3%). Table 1 shows further details on the demographic characteristics of 343 outpatients diagnosed and treated at Ndera Neuropsychiatric Hospital.

Adherence to medications: The majority of participants (56.9%) were partially adherent, 26.2% were adherent, and 16.9% were not adherent to the prescribed medications

Demographic factors associated with poor adherence among our study participants: Participants from urban regions were significantly more adherent to prescribed medication than those from rural areas (p<0.001). Secondary/university level of education was associated with more adherence to medication (p<0.001).

Table 1: *Socio-demographic characteristics of the study population consulting from January up to June 2021*

Characteristics	Number	%
Age		
18-25	58	16.9
26-35	90	26.2
36-45	70	20.4
46-55	77	22.4
56-65	40	11.7
>65	8	2.3
Gender		
Male	174	50.7
Female	169	49.3
Marital status		
Single	119	34.7
Widow	68	19.8
Married	117	34.1
Divorced	39	11.4
Education		
None	121	35.3
Primary	128	37.3
Secondary	65	19.0
University	29	8.5
Occupation		
None	197	57.4
Self-employed	88	25.7
Employed	51	14.9
Student	7	2.0
Region		
Urban	175	51.0
Rural	168	49.0
Religion		
Protestant	145	42.3
Muslim	105	30.6
Catholic	93	27.1

*Protestant includes all types of christian religions other than Catholic

Married and employed patients were more likely to be adherent to mediation than other categories (p=0.045 and p=0.013, respectively). No statistically significant difference was observed among different age groups, genders, and religious groups regarding adherence (Table 2).

Face-to-face interviews

Comprehension of disease and treatment: Most

participants mentioned that a low understanding of their disease is the major factor contributing to their poor adherence to antipsychotic medications.

"I don't even understand my condition, which limits me from taking well the prescribed medications" [Participant 61]

"...I don't have enough information on my condition and the medications they give me because sometimes I think that I am not suffering from any medical condition, and this makes me hate myself and lose the courage to take the medications" [Participant 43]

Perception of illness: Participants mentioned that they don't accept that they have schizophrenia, leading to non-adherence to the medications.

"I don't accept that I am sick of any disease…… I don't agree with health providers because they don't explain well the disease to me" [Participant 173]

"I hear a voice that prohibits me from taking medications, I don't get well, and I don't even accept that I have this disease…." [Participant 231]

"I don't know enough about this disease, but sometimes I hear voices telling me to stop

Table 2: *Association between adherence and participants' characteristics*

Characteristics	Adherence category			P value
	Non-adherent	Partially adherent	Adherent	
Age				
18-35 years	39 (19.9%)	107 (54.6%)	50 (25.5%)	0.232
36-55 years	19 (12.9%)	88 (59.9%)	40 (27.2%)	
Education				
No education	32 (26.4%)	63 (52.1%)	26 (21.5%)	
Primary	24 (18.8%)	74 (57.8%)	30 (23.4%)	<0.001
Secondary/University	2 (2.1%)	58 (61.7%)	34 (36.2%)	
Gender				
Male	33 (19.0%)	100 (57.5%)	41 (23.6%)	0.391
Female	25 (14.8%)	95 (56.2%)	49 (29.0%)	
Marital status				
Single	26 (21.8%)	63 (52.9%)	30 (25.2%)	
Widow	15 (22.1%)	40 (58.8%)	13 (19.1%)	0.045
Married	12 (10.3%)	65 (55.6%)	40 (34.2%)	
Divorced	5 (12.8%)	27 (69.2%)	7 (17.9%)	
Employment status				
None	44 (22.3%)	109 (55.3%)	44 (22.3%)	
Employed	6 (11.8%)	27 (52.9%)	18 (35.3%)	0.013
Self-employed	6 (6.8%)	55 (62.5%)	27 (30.7%)	
Student	2 (28.6%)	4 (57.1%)	1 (14.3%)	
Region				
Urban	16 (9.1%)	100 (57.1%)	59 (33.7%)	<0.001
Rural	42 (25.0%)	95 (56.5%)	31 (18.5%)	
Religion				
Catholic	15 (16.1%)	55 (59.1%)	23 (24.7%)	
Protestant	22 (15.2%)	86 (59.3%)	37 (25.5%)	0.737
Muslim	21 (20.0%)	54 (51.4%)	30 (28.6%)	

the medications…God will heal me, I know"
[Participant 29]

Belief about treatment: Participants expressed that they don't take their medications well because of fear of the side effects of the medications.

"….and these medications cause me dizziness, weakness, and deep sleep, and it also causes me to gain more weight" [Participant 7]

"These medications make me weak, and they cause me to sleep a lot and to have erectile dysfunction" [Participant 27]

"The medications make my body weak. Sometimes they make me sleepy, and they cause me to get more weight, but I try my best to take them even though they cause me side effects" [Participant 30]

"The medications cause me tremors, too much saliva secretions, gaining weight, and they also make me very sleepy" [Participant 161]

Outcome expectations: Participants mentioned that the other reason for not adhering to the treatment is that they are bored and tired of having a long-term disease that requires them to take medications on a timely basis.

"It's been more than 10 years of taking the medications but no improvement, and for now, I feel tired of taking them, and sometimes I forget to take them." [Participant 13]

"I usually forget to take the medications as it has been seven years since I took them. I feel tired and bored of this disease and don't get better at all..." [Participant 10]

"I feel tired of this disease because it is now five years taking medications and I don't get well, and the disease persists ...." [Participant 16]

Cost and lack of social support: Participants mentioned the lack of means to buy medications prescribed by health providers and money to travel to the health facility for follow-up and prescription refills.

"I take two types of medications, which I find to be too much for me because to get the medications is difficult because I live too far from here, and it is not easy to get money for transport and even for buying them…." [Participant 2]

"I live far from here, and coming to the hospital costs me a lot, and sometimes I can't find money to pay the transport or medications, and my family does not care about me anymore as they now call me a fool" [Participant 8]

"It is difficult to get money as I don't have a job, and my family/friends do not care about me." [Participant 5]

Some participants mentioned that they get busy with their daily work and do not get the time to come to the health facility to get prescription refills and follow-up tests, which contributes to their poor adherence to antipsychotic medications

"My occupation doesn't allow me to come here regularly for follow-up and for getting medications at the time, and this causes me to skip some doses." [Participant 39]

"My daily work makes me lose time to come here to the hospital regularly..."   [Participant 59]

Stigma of disease: Participants reported that discrimination in their families, neighborhood, and among their relatives and friends resulted in poor self-esteem and made them change their behavior and values in society, leading to the refusal to follow up on their disease, start getting drunk, and other bad behaviors.

"…. Coming here at Ndera Hospital always makes me ashamed of myself because people call me mad..." [Participant 11]

"In my family, they isolate me, which makes me feel ashamed of myself and also makes me want to drink a lot to get over everything because when I am drunk, I feel better…." [Participant 17]

"I feel ashamed coming here at Ndera Neuropsychiatric Hospital because when I come here, people neglect me, calling me a fool…." [Participant 19]

Religious and cultural beliefs: Many participants expressed religious and social beliefs, including praying for the disease, drinking alcohol, and smoking tobacco to make them feel comfortable with their condition instead of taking the prescribed medications.

"Prayers make me feel better than medications, and God revealed to me that He will do a miracle for me one day." [Participant 5]

"I love to smoke and drink alcohol a lot. When I take tobacco or alcohol, I feel much better…." [Participant 18]

"When I drink alcohol or smoke, I feel good and forget about my condition…." [Participant 34

Healthcare provider-patient relationship and communication: Participants mentioned that they face the challenge of communicating with

healthcare providers when they present for consultations and follow-up, which discourages them and contributes to their poor adherence to medications.

"I am not happy with the quality of services we get from here because we ask questions about how long we are going to take medications and time to stop. They do not explain well. It discourages me a lot…," [Participant 48]

"I take two types of medications which I find to be too much for me, and they do not involve us in decision making or explain well some side effects from medications…." [Participant 2]

"We encounter poor customer care because of a very long waiting time where you may come in the early morning and get back at the very night, and they do not give you the reason why it is like that every time …." [Participant 7]

DISCUSSION

Non-adherence to medication among patients diagnosed with schizophrenia is a complex and multifaceted public health problem with various contributing factors [3,8,9]. Our study aimed to identify the factors contributing to non-adherence to prescribed medication in this patient population. We meticulously recorded their social and demographic characteristics and assessed their level of adherence to prescribed medications. Our findings showed that only 26% of the participants adhered consistently to their prescribed medications, indicating that 74% struggled with adherence. Among these non-adherent participants, 56.9% exhibited partial adherence, while 17% were entirely non-adherent. This is a higher non-adherence rate compared to the 40%-50% range reported in previous studies [11]. Furthermore, it is higher than the 35.8% non-adherence rate identified in a study involving 217 schizophrenic patients in South Africa [7]. Interestingly, our findings show a higher rate than the 50% non-adherence rate reported by the World Health Organization (WHO) for patients with chronic diseases in developed countries [12], while slightly higher than 67.5% non-adherence rate observed in a previous study at the University Teaching Hospital of Kigali psychiatry department [13].

Geographic location emerged as a significant factor, with urban-dwelling participants exhibiting greater adherence to prescribed medication compared to their rural counterparts (p > 0.001). This finding suggests that a patient's residential area may influence their compliance and behavior toward healthcare provider recommendations. This aligns with previous studies showing that urban residence was associated with increased medication adherence [14–16]. Ndera Neuropsychiatric Hospital and its branches are located in urban areas, contributing to limited access to its services for rural participants. Participants reported that that lack of time and financial means for transport to the hospital contribute to missing appointments, aligning with another finding that adherence was better among employed participants since they have the financial capacity to attend appointments and buy medications. Employed patients also have access to better insurance to cover the cost of medications, leading to better adherence compared to unemployed patients [17]. Additionally, we found that educational attainment was associated with adherence, as participants with higher levels of education demonstrated better adherence (p < 0.001). This aligns with other previous studies [6,18]. Patients with higher education levels often have a better understanding of their condition and treatment, promoting medication adherence [19].

The persistence of symptoms and the chronic nature of the disease also played a role. These findings aligned with those from an Indian study, which identified common factors for poor adherence: limited access to healthcare facilities, lack of family or social support, stigma, a perceived lack of symptom improvement, and financial constraints [7]. This Indian study also highlighted side effects from medication, negative perceptions, occupational demands, stigma, and a lack of caregivers as factors of non-adherence, aligning with other previous studies [4,20]. Our study's participants similarly cited fear of medication side effects as a deterrent to adhere to medications, in addition to lack of family and social support, limited awareness of their condition, long-term duration of illness, and busy daily schedules. Other studies align with our findings by showing that patients who experienced side effects and who have limited awareness of the disease tended to discontinue prescribed antipsychotic drugs [6,21,22]. Richardson et al. also noted that the duration of illness and symptom improvement influenced non-adherence [23].

Our study's participants mentioned alcohol consumption and tobacco use as factors

contributing to their poor medication adherence. Some believed they felt better when under the alcohol influence, leading them to skip medications. These findings paralleled those of a study in Nepal by Singh, where substance use accounted for 19% of non-adherence cases [21]. Furthermore, denial of the disease and poor knowledge emerged as significant barriers to adherence, highlighting the need for regular and comprehensive patient education and community awareness programs. Stigmatization within communities also hindered follow-up attendance, emphasizing the necessity for community education regarding psychotic disorders as manageable and not stigmatized conditions. These findings were also reported by other studies conducted previously that stigma and shame about the diseases and treatment result in poor adherence [24,25]. Patients with mental illness are stigmatized in society and are considered fools or mad, which may discourage patients from adhering to medications. Our participants reported that some community members call them fools, and when they visit the hospital, they become targets as fools in the fools' hospital. This discourages them from attending appointments and going for refills of their prescribed medications.

This study was limited by its cross-sectional design, which is prone to selection and recall biases. It is also limited in establishing control for confounding factors, making isolating the true relationship between the variables of interest challenging.

This study relied on self-report statements, which might lead to over- or under-reporting and response biases. This might affect the generalizability of its findings. Therefore, longitudinal and intervention studies prospectively studying schizophrenia patients in Rwanda are recommended.

CONCLUSION

Our study revealed a high prevalence of non-adherence to prescribed medications among schizophrenia patients, with multiple contributing factors, including low educational levels, unemployment, financial constraints, lack of support (familial and social), rural residence, fear of side effects from medications, lack of understanding of the disease, stigma, chronicity of the condition and social behaviors. Addressing these challenges requires a multifaceted approach encompassing education, support, and raising awareness at the individual and community levels. Healthcare providers should enhance patient education sessions at the waiting areas and improve the patient-healthcare provider relationship regarding information provision to patients about their diseases. Ndera Neuropsychiatric Hospital is recommended to organize regular outreach activities to areas without psychiatric centers to facilitate patients with psychotic disorders to get services. Family members need to be involved in the follow-up of schizophrenic patients and provide financial and social support to them.

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Rwanda
Public Health Bulletin

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The Rwanda Public Health Bulletin (RPHB) is a printed and open access, peer-reviewed journal, published as the flagship scientific and technical periodical publication. RPHB is a public health bulletin launched in March 2019 by the Rwandan Ministry of Health, through the Rwanda Biomedical Centre (RBC) in collaboration with the CDC Foundation and with support from Bloomberg Philanthropies Data for Health Initiative.

Mission

To serve as a scientific information dissemination platform of national and international significance, mainly in areas related to the Rwanda Ministry of Health's essential mission to strengthen national and local health systems and improve the health of the people of Rwanda. The Rwanda Public Health Bulletin publishes disease surveillance summaries, public health response guidelines, public health notices, case reports, outbreak reports, original research papers, and policy briefs among others. It generally features issues of importance to its targeted audience, which is health professionals, academic researchers, policymakers and anybody interested in health issues. Articles for publication are received from doctors, nurses, allied health professionals, students, policymakers, government bodies, non-governmental bodies and others.

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INSTRUCTIONS TO AUTHORS

All works submitted to this bulletin will have to belong to the types of articles stated below:

1. ORIGINAL RESEARCH

Referred to as "Primary Research" pioneer in a determined domain. It can be from various aspects: Clinical features, pathophysiology, biochemistry, molecular biology, etc...

THE TITLE

The title of the article should be concise and informative. It should contain enough thoughts on the subject.

ABSTRACT

Abstract of 250 words maximum must accompany each manuscript and be divided into 4 paragraphs with the following headings and MeSH keywords:

Introduction: stating the purposes/aims of the work; the research undertaken, the hypothesis tested or the procedure evaluated.
Materials and methods: briefly stating what was done and what materials were used, including the number of subjects, the methods to assess the data and to control bias.
Results: Providing key findings of the study, including indicators of statistical significance, actual numbers, as well as percentages.
Conclusion: Summarizing in 1 or 2 sentences the work on the basis of the findings. It emphasizes new and important aspects of the study or observations.

THE MAIN TEXT

The text of observational and experimental articles is divided into sections with the following headings: Introduction: should always begin the text, and requires brevity and focuses. It conveys the nature and purpose of the work, and quotes the relevant literature. Only strictly pertinent background information is necessary for understanding why the topic is important. We suggest the final paragraph clearly states the hypothesis or purpose of the study.

METHODS

Details of clinical and technical procedures should follow the introduction. A clear description of the selection of the observational or experimental subjects should be given. The identification of all aspects of the study, its reasoning, and the related relevance should be explicitly justified. In case, the study was done in a particular way, the guiding principles should all be clarified. Exclusion and inclusion criteria or partial inclusion, the reliability index, the confidentiality index, the analysis step, and the data collection processes should be also carefully specified. This section should provide sufficient details on the methods, instrumentation, procedures, all drugs and chemicals used (including generic names, doses, routes of administration). It should allow other workers to reproduce the study if necessary.
This section should also state the self-evaluation of the study by: independent/consensus readings blinded or unblinded to other information and estimate the fluctuation of recall biases by random ordering of studies.

Be clear about the retrospective or prospective nature of the study. Finally, provide references to established methods, including statistical methods that have been published, forthcoming, or that may not be well known. New description or substantially modified methods may be used however, give reasons for the use of these techniques, and evaluate their limitations. Statistical methods should be described with enough details to enable a knowledgeable reader with access to the original data to verify the reported results. A general description of methods would be defined in the methods section, whereas a specific statistical method used into analysis would be summarized in the results section. Any general use of the computer program should be

specified, and more details have to be clarified about any randomization issues.

RESULTS

Logical sequence of presentation of results is required in the text; along with tables, and illustrations. Repetition of data from illustrations into the text should be avoided; however, emphasize or summary of only important observations would be helpful. Avoid the ''non-technical use'' of technical terms in statistics which should be defined and reserved for the right purpose. Moreover, define all those statistical terms aside with or including abbreviations and/or most used symbols. Any complication and/or unexpected finding should be reported and the more possibly explained and the author should report lost to follow up and dropouts from a clinical trial.

DISCUSSION

Use ample subheadings. Emphasize the new and important aspects of the study and the conclusions that follow from them. Avoid repetition of details included in other parts. This section requires the mention of the implication of the findings, and their limitations for future research, involving relating the observations to other relevant studies.

Finally, the conclusions should be linked to the goals of the study; though mostly avoiding:

Unqualified statement not completely supported by the data

Statement on economic benefits and costs unless the report includes economic data and analyses

Claim of priority and alluding to work that has not been completed.

Whereas new hypotheses could be suggested when warranted, but they should be clearly labeled as such and recommendations, when appropriate and needed, may be given.

Acknowledgments

List all contributors who do not meet the criteria of authorship, such as those who provided purely technical help, writing assistance, or a department chair who provided only general support; and their respective contribution will be headed as provided. Everybody must have given written permission to be acknowledged.

REFERENCES

References should be numbered consecutively in the order in which they were first mentioned in the text. They will be identified in the text, tables, and legends by arabic numbers. This bulletin uses the IEEE style (Institute of Electrical and Electronics Engineers) for referencing the citations. It is advised to avoid citations or personal communication unless they provide essential and pertinent information. In all case, the name of the person and date of communication should be cited in parentheses in the text.

2. CHECKLIST FOR SURVEILLANCE REPORTS

Disease surveillance summaries are reported following the checklist below:
Title: Compose a title that includes the name of the health condition, population, time and place.
Abstract: Provide a structured abstract including the following sub- headings: Background; Objectives; Methods; Results; and Conclusion.

INTRODUCTION

Context: Summarize the current situation regarding the health condition under surveillance and identify why it is important. Objectives: State the objective of the surveillance report.

METHODS

Setting: Describe the setting, locations and dates of the surveillance period.

Population: Describe the population under surveillance. Definitions: Provide definitions for each health event under surveillance, including case definitions and any public health interventions. **Information sources**: Describe all data sources, including the objective of any surveillance systems, what data were collected and how data were gathered, transferred and stored. Supplementary data: If appropriate, note where to access supplemental material (e.g., www.opendata.gc.ca). **Data quality, missing data and reporting delays:** Describe how the data quality was assessed. Explain how missing data were addressed. If data is reported by date of diagnosis or symptom onset, include a statement about whether the data for the most recent periods may be revised.

DATA ANALYSIS

Describe any analytical methods used providing sufficient detail to enable a knowledgeable reader with access to the original data to judge its appropriateness and to assess the reported results.

RESULTS

Descriptive: Provide a summary of the descriptive data, including demographics.
Data Quality: Report on data quality (e.g., completeness, missing data, under reporting)
Analytic data: Provide a summary of the analysis including (when indicated) estimates of trends. When applicable, point estimates should include appropriate indicators of measurement error such as 95% confidence intervals (e.g., average annual percentage change used to describe trends or odds ratios used to describe subgroup differences).
Figures: Create the minimum number of figures to highlight key results. Create a title that includes person, time and place.

DISCUSSION

Key results: Summarize key results with reference to study objectives
Comparison: Consider these findings in relation to the current literature. Strengths and weaknesses: Discuss the strengths and weaknesses of the study (data quality, completeness, sources of potential bias). Interpretation and generalizability: Provide a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies and other relevant evidence.
Conclusion: Ensure conclusions address objectives and follow from the results.

3. PUBLIC HEALTH NOTICES / OUTBREAK REPORTS

Following the Center for Disease Control recommendations, for public heath notices and outbreak reports to be published they need to cover all four components as stated below:

INTRODUCTION

Generally, the introductory paragraph should begin with 1 to 3 sentences establishing the existence of the outbreak or underlying public health problem. E.g., "On January 2, 2008, the Nevada State Health Division contacted CDC concerning surveillance reports received regarding two persons recently diagnosed with acute hepatitis C." The introductory paragraph also usually contains: a) a statement that an investigation was conducted, when and by whom; b) the most important finding(s); c) the actions taken to stem the outbreak; and d) a statement of the public health implications and actions that should be taken in response to the investigation. Investigation and results: First, present the initial investigation and its findings. This might include: 1) a description of the setting and a statement of how the outbreak came to the attention of health authorities; 2) a clinical description of the index case or initial cases; 3) initial key test results; and 4) hypothesis generation activities and results. Next, summarize the full investigation, including: case definition, case-finding activities, method of investigation, and results. Cases should be counted and described by clinical characteristics, treatment,

and outcome, as well as time, place, and person descriptive results. Next, present the methods and results of any analytic epidemiologic studies (e.g., cohort or case-control studies). Finally, provide the results of any relevant microbiologic, genetic, or toxicologic results, followed by the results of any testing of environmental samples. Public health response: When appropriate, a brief description summarizing any public health interventions taken and the results of the interventions follows.

DISCUSSION

Same as for a Full Report, except that a Limitations paragraph might not be required for an Outbreak Report.

4. POLICY BRIEFS

This bulletin will use guidelines on reporting/ publishing policy notes as they are suggested by the Center for Disease Control (CDC). As the CDC defines them; Policy Notes are intended to announce new official policies or recommendations (e.g., from ACIP or CDC). These reports can be thought of as briefs. Maximum word count at submission is 1,400 words. Up to three tables, figures, or boxes may be included. Policy Notes contain no Discussion or Limitations, and a summary box is not required. Although policy notes or brief might vary, following is a rough guide of what basic notes should have: Introduction: The introductory paragraph should be limited to 150–200 words. It might contain all or some of the following components: a brief introductory statement orienting the reader to the topic and placing it in context, a brief description of the public health problem, a brief statement of the rationale for the policy or recommendation, mention of the most important parts of the policy or recommendations, and one or two sentences stating the conclusions and the public health implications of the new policy or recommendations.

BACKGROUND

The Policy Note should include a paragraph after the introduction that summarizes background information relevant to the policy or recommendation that can help the reader understand the context and need for the policy or recommendation.

Methods: Should include a summary of the methods used to establish the policy or recommendation, including answers to some or all of these questions: Who was involved in the production of the guidelines or recommendations, and how? What evidence base was considered? What was the rationale for considering this evidence base? Was other evidence excluded from consideration and, if so, why? Rationale and evidence: The Policy Note should provide a concise review of the rationale for the policy or recommendation and a descriptive review of the scientific evidence used to establish it. It should include an explanation of how the policy or recommendation adds to, or differs from, relevant policies or recommendations established previously. Presentation of the policy or recommendation: The policy or recommendation should state clearly when it takes effect and to whom and under what circumstances it applies.

DISCUSSION OR COMMENT

The Policy Note should comment on the likely impact of the new policy or recommendation and plans for assessment of the policy or recommendation

5. CASE REPORTS

These are reports of an individual patient on their symptoms, treatment reactions on a disease or condition of interest. These reports normally focus on unusual reactions or occurrences. Similar cases to other research reports, case reports might include a literature review of previous similar. Case reports might also address positive patient outcome on particular treatment guidelines or individual impact of a particular intervention. These are mainly used for educational and decision-making purposes.

Case reports are normally reported following a checklist found at the CARE Guidelines.

6. CASE STUDIES

We recommend authors to follow the "EQUATOR Network" for ample explanations and guidelines in the writing of such articles. They have to be well-described case studies on health care interventions of public health concern. These could be:

Rigorous assessments of processes and program interventions.

Recommendations on possible health interventions.

Never on individual patient (= case report)

7. COMMENTARIES / OPINION / METHODOLOGY ARTICLES

We recommend authors to follow the "EQUATOR Network" for ample explanations and guidelines in the writing of such articles. Though these articles are moderated, they should be:
Short, focused, opinionated to previous articles or any subject related to the journal entirely.
Contemporary and focusing on specific issues.
Normally up to 800 words.

Frank critics to the journal are bravely motivated and would be as much as possible published.

8. FORMATTING THE MANUSCRIPT

Please note that articles which are not correctly formatted will be returned to the authors

Format text: Style: No Spacing, Single column, Single Spacing
Font: Single Spacing, Times New Roman - size 12
Titles: Capitals and bold, size 14
Format tables: Times New Roman, Font size 9
No vertical lines. Horizontal lines in the table can be removed. No table should be larger than a single A4 page. Footnote should be size 9 and italic.

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Acknowledgement

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