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Health Outcomes, Sequelae, and Physiological Profile of Ebola Survivors with Post-Recovery Syndrome in Sierra Leone: A Retrospective Cross-Sectional Study

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ABSTRACT

Background: Towards the end of the 2014 – 2016 Ebola Virus Disease outbreak in Sierra Leone, the government and its partners established specialized clinics to provide integrated primary healthcare services for survivors. These services aimed to address the complex health challenges faced by survivors after discharge from the Ebola Treatment Units (ETU), many of whom developed post-Ebola syndrome. These survivors continue to suffer a range of physiological and physical problems that directly affect their general well-being. This study describes the health outcomes and physiological profiles of Ebola Virus Disease survivors, focusing on nutritional parameters as proxies for physiological status.

Materials and Methods: Data was collected from medical records and questionnaires at two clinics, the 34th Regimental Military Hospital Ebola Survivors Clinic in Freetown and a Mobile Health Clinic (MHC) operating in Bombali and Port Loko districts. This study period was from February, 2015 to December 2016 and included 166 EVD survivors (49 men and 117 women), aged 19 – 65 paired with a control group of 113 household contacts (69 men and 44 women). The data collected covered self-reported health statuses, anthropometric measurements and physiological parameters recorded from baseline visits. Body Mass Index (BMI) was used as a measure of overall physical status to capture both the health outcomes and broader physiological profiles of survivors.

Results: Sequelae were significantly more frequent among survivors than household contacts ($p < .05$). The most common nutritional sequelae included diarrhoea (43.4%), loss of appetite (41.6%), and nausea/vomiting (37.9%). Survivors had a significantly higher mean BMI than household contacts ($p = .004$), with the opposite pattern observed for height ($p < .001$) and weight ($p = .023$). Among survivors, the mean BMI was 24.73±4.9 Kg/m² (range, 14.7 – 53.4 Kg/m²), with 51.8% having a normal BMI, 4.8% being underweight, 30.7% overweight, and 12.7% obese. Significant differences were observed between gender and BMI categories ($x^2 = 16.420$; $df = 3$; $p = .001$), with female EVD survivors more likely to be obese (17.1%). While there was a low positive non-significant association between survivors' BMI and duration at the ETU ($r = .107$, $p = .25$), a significant low positive association was found between survivors' age and ETU duration ($r = .31$, $p = .001$). The regression model was not significant in predicting most nutritional sequelae; but, it did

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significantly predict nausea/vomiting as nutritional sequelae (χ^2 [5] = 11.69, p = .039), with female survivors at greater odds.

Conclusion: This study highlights the importance of addressing complex health challenges faced by EVD survivors with post – Ebola syndrome. To improve access to necessary care and enhance health outcomes, we recommend exempting EVD survivors from premium payments under the Sierra Leone Social Health Insurance (SLeSHI) scheme to facilitate better access to healthcare services, particularly interventions supporting their recovery and long-term well-being.

Keywords: Ebola Survivors, Post – Ebola Syndrome, Health Outcomes, Physiological Profile, Nutritional Sequelae

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INTRODUCTION

Since the discovery of Ebola Virus Disease in northern Democratic Republic of Congo in 1976, outbreaks had typically been localized and confined to rural areas. However, the 2014 outbreak in West Africa, which disproportionately affected Sierra Leone, Liberia, and Guinea, demonstrated the potential for Ebola to spread rapidly and cause large-scale crises, with over 28,600 reported cases (WHO, 2016). While the global response to the outbreak was ultimately successful in containing the virus, the long-term health impacts on survivors became a growing concern. One of the most significant findings was the recognition of post-Ebola syndrome (PES), a condition characterized by a range of persistent physical, psychological, and physiological health disorders. This syndrome was first observed in survivors of the 1995 EVD outbreak in the Democratic Republic of Congo (Bwaka et al., 1999; Rowe et al., 1999).

In Sierra Leone, the substantial number of EVD survivors presented unique challenges, necessitating the establishment of specialized clinics to address their post-recovery healthcare needs. Despite these efforts, survivors continued to experience a range of debilitating PES, including arthralgia, fatigue, uveitis, hearing loss, and neurological sequelae. In addition to these, nutritional impairments emerged as critical factors contributing to compromised health outcomes. Acute symptoms of EVD, such as gastrointestinal distress, loss of appetite, and sore throat, likely triggered long-term nutritional deficiencies. These deficiencies may have further increased survivors' vulnerability due to immune dysfunction, leading to greater susceptibility to infections (Harthil, 2011; Scott et al., 2016; Guetiya et al., 2017).

While much of the existing literature on the long-term sequelae of EVD has focused on the psychological and physical sequelae, less attention has been given to the overall physiological profile of survivors, particularly their nutritional and metabolic health (Mattia et al., 2016; Tiffany et al., 2016; Jagadesh et al., 2018). This gap underscores the need for more comprehensive evaluations of the health outcomes and physiological changes that occur post-recovery. Previous studies have highlighted the interrelation between micronutrient deficiencies, malnutrition, and the persistence of viral activity in bodily fluids (Ramanathan & Taylor, 1997; Taylor et al., 1997; Kesel et al., 2014). However, the correlation between nutritional health and the overall physiological condition of EVD

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survivor's remains underexplored. Given the potential for nutritional deficiencies to exacerbate health outcomes, the World Health Organization (WHO) issued guidelines emphasizing the importance of nutritional care during the acute phase of EVD and the necessity for long-term medical care towards survivors (WHO, 2014). Nevertheless, the specific health outcomes related to nutrition and physiology among EVD survivors in Sierra Leone remain insufficiently studied.

Nutritional sequelae refer to long-term or persistent health issues related to nutrition that arise following major diseases or treatments, such as malnutrition, weight fluctuations, or gastrointestinal disorders, all of which can adversely impact physiological functioning and overall wellbeing (Ajumobi et al., 2017; Awuuh et al., 2018; Lelijveld et al., 2016; Chimusoro et al., 2018). In the case of Ebola virus disease survivors, these sequelae may comprise a range of physiological impairments associated with acute nutritional deficits experienced during the infectious and recovery stages. Research suggests that individuals who survive severe acute malnutrition, a common complication of EVD, often face lasting health consequences, including heightened risk of chronic diseases, immune dysregulation, and impaired physical and neurodevelopmental outcomes. Consequently, the physiological profile of EVD survivors may exhibit analogous patterns of nutritional deficiencies, metabolic dysregulation, and related comorbidities (Lelijveld et al., 2016; Galler & Barrett, 2001; Babameto & Kotler, 1997; Calder et al., 2021).

Therefore, this study aimed at addressing this gap by investigating the health outcomes and physiological profile of EVD survivors with PES in Sierra Leone using nutritional parameters as proxies for physiological health. Our findings are expected to offer valuable insights into the broader health complications experienced by EVD survivors, serving as a baseline for the development of more effective interventions to support this vulnerable population.

MATERIALS AND METHODS

Description of Ebola Survivor Clinics

In February 2015, the University of Rome Tor Vergata (UTV) in Italy, in collaboration with the Diocese of Makeni, established a Mobile Health Clinic aimed at providing integrated primary healthcare services to Ebola Virus Disease (EVD) survivors experiencing PES in remote communities with limited medical access. The clinic's primary objective was to address the physical and psychological sequelae faced by survivors (Guetiya et al., 2017). Similarly, the Ebola Survivors' Clinic at the 34th Regimental Military Hospital (MH34) was

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established towards the end of the epidemic within the premises of the MH34 Ebola Treatment Unit (ETU). Its mission was to provide medical care for the physical and psychological challenges experienced by EVD survivors treated at the MH34 ETU (Scott et al., 2016).

Study Population and Data Source

This study employed a convenience sampling method to gather data from survivor clinic databases. Inclusion criteria were as follows: participants aged 19-65 years, residing in Sierra Leone, who provided written informed consent. Exclusion criteria included participants with acute disease conditions presenting symptoms similar to the targeted sequelae, missing nutritional and anthropometric data, or incomplete demographic information (Figure 1). The study was conducted in accordance with the standards of the International Committee on Harmonization on Good Clinical Practice and the revised version of the Declaration of Helsinki. All subjects provided voluntary consent by signing or fingerprinting a written consent form. The Sierra Leone Ethics and Scientific Review Committee approved this study, and it was conducted in compliance with the relevant guidelines and regulations set forth by the Sierra Leone Ministry of Health.

Measurement

Demographic data, including gender, age, marital status, and region of residence, were collected through questionnaires administered to all participants. Trained physicians or researchers recorded persistent nutritional sequelae reported by survivors using structured data collection forms. Standardized protocols were followed to measure anthropometric indices, such as weight and height, to the nearest 0.1 kg and 0.1 cm, respectively, with participants wearing lightweight clothing and no shoes. Body Mass Index (BMI), recommended by the WHO as a proxy for nutritional status, was calculated using the measured weight and height during the participants' first clinic visit (WHO, 1995). BMI categories were defined according to WHO standards: underweight (BMI < 18.5 kg/m^2), normal weight (BMI 18.5-24.9 kg/m^2), overweight (BMI 25-29.9 kg/m^2), and obese (BMI ≥ 30 kg/m^2).

Statistical Analysis

Data were extracted from medical records and questionnaires documented between June and September 2024. All eligible participants were included in the analysis. The data were first entered into Microsoft Excel and subsequently imported into the Statistical Package for Social Sciences (SPSS) version 20 (IBM Corp.,

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Armonk, NY) for analysis. The percentage of survivors reporting specific outcomes was calculated. Anthropometric measurements and gender were treated as independent variables and compared with household contacts using appropriate statistical tests, including the T-test and Mann-Whitney U-test. Chi-square tests were used to analyse the relationship between BMI categories and gender, as well as BMI categories and age groups. Correlation analysis was performed to examine the association between age, duration at the ETU, and BMI. To assess whether nutritional sequelae were independently associated with nutritional status, age, gender, marital status, and duration at the ETU, binary logistic regression was performed using JMP Pro 14 software (SAS, USA). Each nutritional sequela was treated as a dependent variable, with the aforementioned factors as independent predictors. All analyses were two-tailed, and statistical significance was set at a P-value of .05.

RESULTS

In total, 279 participants were enrolled in the study as shown in Table 1, including 166 survivors (49 men and 117 women) and 113 household contacts (69 men and 44 women), as outlined in Figure 1. Initially, 238 survivors of the Ebola virus disease were included in the study, and the predetermined exclusion criteria were applied to all participants. Individuals who were 65 years or older, under the age of 19, and those with missing essential data, including anthropometric indices and demographic characteristics, were excluded, resulting in a total of 166 participants. The baseline visit to the clinics occurred at an average age of 34.5 years (IQR: 27, 40). The interviews were conducted, on average, 540 days after discharge from the ETU, with an interquartile range of 437 to 682 days.

Table 2 presents a summary of the prevalence of nutritional sequelae among survivors and their household contacts, as reported during baseline visits to the clinic. The most commonly reported sequelae related to the nutrition were diarrhoea (43.4%), loss of appetite (41.6%), and nausea/vomiting (37.9%). Survivors reported all symptoms significantly more frequently than household contacts (all $p<.05$).

The results of anthropometric measurements for male and female survivors and their household contacts are presented in Table 3. Overall, the mean BMI of survivors was significantly higher compared to that of household contacts ($p=.004$), while the opposite pattern was observed for height ($p<.001$) and weight ($p=$

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.023). Analyses revealed significant differences ($p<.01$) in height and BMI between male and female survivors. The study found that the mean body mass index of the Ebola virus disease survivors was 24.73 ± 4.9 Kg/m2, with a range of 14.7 – 53.4 Kg/m2. Out of the total sample, 86 (51.8%) survivors had a normal BMI, while 8 (4.8%) were underweight, 51 (30.7%) were overweight, and 21 (12.7%) were obese.

These findings provided the context for further exploration of gender and age-related differences in BMI and nutritional sequelae. Subsequently, the participants were classified into different categories according to the World Health Organization guidelines, and the relationship between BMI and gender and age groups was analysed. The findings showed that 40% of female EVD survivors were overweight, while only 18% of male EVD survivors were in the same category (Table 4).

The chi-square test revealed significant differences in BMI between genders across four categories ($x^2 = 16.420$; df =3; $p = .001$). Although the association was weak (Cramer's V=.0315), obesity was more prevalent among female EVD survivors (17.1%).

Furthermore, analysis of the data revealed that EVD survivors aged 19-34 years had a lower prevalence of overweight (28.7%) compared to other age groups (Table 5). In contrast, survivors aged 35-50 years had a higher frequency of obesity (23.3%). This relationship between BMI categories and age groups of survivors was statistically significant ($\chi^2 = 15.317$, df = 6, p = .018).

In order to investigate the potential associations between BMI, age, discharge to visit at the clinic, and duration at the ETU, Pearson correlation analysis was conducted (Figure 5). The results indicated a significant negative correlation (p=.02, r= -.203) between the BMI of EVD survivors and the time elapsed between their release from the ETU and their baseline visits to the clinic (Figure 2).

However, we observed a low positive non-significant correlation (p=.25, r=.107) between the BMI of EVD survivors and duration at ETU (Figure 3). Similarly, a low positive significant correlation (p=.001, r=.310) was observed between the age of EVD survivors and duration at the ETU (Figure 4).

A logistic regression analysis was conducted to investigate the potential influence of various factors, including age, gender, marital status, duration of stay at the Ebola Treatment Unit, and nutritional status (measured by Body Mass

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Index), on the likelihood of developing nutritional sequelae among Ebola virus disease survivors. The results revealed that the nutritional status of survivors did not predict any of the reported nutritional sequelae. Specifically, the regression model did not demonstrate statistical significance in predicting the likelihood of experiencing loss of appetite ($\chi 2$ [5] = 7.69, p > .05), diarrhoea ($\chi 2$ [5] = 3.89, p > .05), sore throat/pain swallowing ($\chi 2$ [5] = 8.88, p > .05), hiccups ($\chi 2$ [5] = 6.68, p > .05), or constipation ($\chi 2$ [5] = 4.89, p > .05) as nutritional sequelae.

However, the regression model demonstrated statistical significance in predicting the likelihood of experiencing nausea or vomiting as nutritional sequelae ($\chi 2$ [5] = 11.69, p = .039), explaining 68% (Cox & Snell R2) of the variance in the development of this nutritional sequelae. The model accurately classified 64.5% of cases, correctly predicting 93.2% of survivors who did not have nausea/vomiting as nutritional sequelae and 17.5% of survivors who did have nausea/vomiting as nutritional sequelae. Additionally, gender (p= .006) was found to significantly contribute to the prediction of the likelihood of developing nausea or vomiting as nutritional sequelae, while nutritional status (p = .661), marital status (p= .668), duration at ETU (p= .293), and age (p= .569) did not significantly contribute to the prediction. Thus, female survivors were found to have 3.139 times greater odds of developing nausea or vomiting as nutritional sequelae compared to male survivors

DISCUSSION

This study presents the first quantitative examination of the health outcomes, sequelae, and physiological profiles of Ebola Virus Disease survivors in Sierra Leone, utilizing nutritional status, specifically Body Mass Index and sequelae, as an indicators of overall well-being. The establishment of specialized clinics to care for PES presented by survivors was an important step in addressing their complex healthcare needs. However, a review of clinical records revealed that survivors continued to experience a range of persistent sequelae months after discharge, a finding aligned with prior research (Harthil, 2011; Scott et al., 2016; Guetiya et al., 2017). Among these, nutritional complications emerged as critical factors contributing to compromised health outcomes, highlighting the need for more comprehensive assessments of survivors' long-term nutritional status and its physiological implications.

The baseline data collected in this study identified diarrhoea, loss of appetite, and nausea/vomiting as the most prevalent nutritional sequelae reported by Ebola virus disease survivors. These findings underscore the

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persistent effects of EVD beyond the acute phase and emphasize the critical role that nutritional impairments play in the overall health of survivors. This aligns with previous research demonstrating that nutritional deficiencies, often triggered by the acute symptoms of EVD such as gastrointestinal distress and anorexia, may exacerbate survivors' susceptibility to immune dysfunction and increase their risk of subsequent infections (Harthil, 2011).

Due to the complex and multifaceted nature of nutritional health, understanding these underlying factors is crucial for designing effective interventions tailored to the needs of Ebola virus disease survivors. This holistic approach encompasses not only clinical management strategies but also initiatives aimed at improving access to essential healthcare services. One potential possibility for enhancing access could involve exempting EVD survivors from premium payments under Sierra Leone's Social Health Insurance scheme, thereby facilitating their ability to obtain necessary healthcare and nutritional support, as suggested by Abraham et al. (2016).

Our study found that women had a higher incidence of elevated BMI, suggesting a greater prevalence of obesity in this group. The observation that the majority of young adult survivors (aged 35-50 years) were overweight or obese raises concerns about their long-term health risks, particularly in comparison to the general population. Notably, 17.1% of female survivors were classified as obese, exceeding the 13.3% obesity rate in the general female population, as reported in the Global Nutrition Report (2017). This suggests that female EVD survivors may be at a heightened risk for obesity-related complications, emphasizing the need for targeted interventions to improve their nutritional status and overall well-being.

Interestingly, BMI was not significantly associated with the time of discharge from the Ebola Treatment Unit (ETU) and baseline clinic visits. However, a low positive correlation between BMI and ETU duration suggests that longer ETU stays may be linked to higher BMI, possibly due to improved supportive care, including rehydration and nutritional support. The World Health Organization's guidelines for nutritional care during EVD include phased feeding strategies (maintenance, transition, and boost feeding) alongside continuous rehydration. These guidelines highlight the critical role of nutrition in patient outcomes but also underscore the gap in specific guidelines for nutritional care upon discharge from the ETU. Although WHO recommends discharge food rations and nutritional assessments for survivors, these practices are not consistently implemented.

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Emerging evidence suggests that poor nutritional health may contribute to immune dysfunction, increasing the risk of subsequent infections. According to Harthil et al. (2011), individuals with micronutrient deficiencies are more susceptible to viral haemorrhagic diseases like EVD. Micronutrients, such as selenium, are crucial for maintaining immune function, and deficiencies may heighten the risk of viral persistence in immune-privileged sites, such as the eye and central nervous system. Addressing these nutritional deficiencies could therefore improve the long-term health outcomes of EVD survivors.

Our regression analysis identified that survivors were more likely to report nausea or vomiting as nutritional sequelae, consistent with findings from other studies (Clark et al., 2007). However, not all studies have reported these symptoms as sequelae months after discharge, indicating variability in the long-term effects of EVD among survivors.

This study has several limitations. First, the study population was limited to adult EVD survivors, reducing the generalizability of the findings to younger populations. Second, the absence of pre-EVD nutritional data prevents us from determining whether the observed sequelae were present before or after infection. Furthermore, nutritional complications may have been influenced by post-discharge conditions or underlying health factors. Therefore, further research is necessary to evaluate the physiological status on a larger cohort of survivors, and incorporating more nutritional markers such as biochemical indicators alongside BMI which could provide a clearer understanding of the long-term impact of EVD on their health and inform the development of more effective clinical interventions.

Despite these limitations, our study fills a critical gap in the literature by highlighting the importance of comprehensive physiological assessments including nutritional status in managing the health of EVD survivors, particularly those experiencing PES. Given the well-established association between malnutrition and poor health outcomes in EVD patients, our findings reinforce the need to integrate nutritional care into management protocols for EVD survivors to improve their long-term health and quality of life.

This research offers crucial insights into the health outcomes, sequelae, and physiological profile of Ebola Virus Disease survivors in Sierra Leone, utilizing nutritional health as a key indicator of overall well-being. The findings underscore the importance of addressing nutritional deficiencies and sequelae, which play a pivotal role in shaping the broader health challenges faced by survivors with post – Ebola

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syndrome. Effective management of these deficiencies, coupled with targeted healthcare interventions, can significantly enhance survivors' health outcomes and quality of life. Furthermore, exempting EVD survivors from premium payments under the Sierra Leone Social Health Insurance (SLeSHI) scheme may facilitate improved access to comprehensive care, including essential nutritional support, sequelae management and long-term recovery and overall well-being of this vulnerable population.

Availability of data and materials

The authors declare that all data supporting the findings of this study are available within the article. The datasets generated, used, and analysed during this study are available upon request.

Ethical Approval

The Sierra Leone Ethics and Scientific Review Committee approved this study and it was conducted according to relevant guidelines and regulations by the Sierra Leone Ministry of Health.

Conflicts of Interest

The authors declare no conflicts of interest.

Authors' Contributions

R.E.G.W. conceived and initiated the study. R.E.G.W, S.S., A.C., M.M., V.C., C.M., M. B. K, A.B.G., and E.J.J.M designed the study, provided guidance for data collection and analysis, and further prepared the original draft of the manuscript. H.M.S., H.R, S.B., M.K., J.M., G.C., A.H.K., J.B., A.F.K., and C.S.S., assisted with the data collection, supervision, editing, and technical support in data inputs and analysis. The draft manuscript was critically reviewed by R.E.G.W., M.M., V.C., C.M., M. B. K., A.B.G., and E.J.J.M. All authors made significant contributions to the final work; read and approved the manuscript for submission; and gave their consent for the manuscript to be published.

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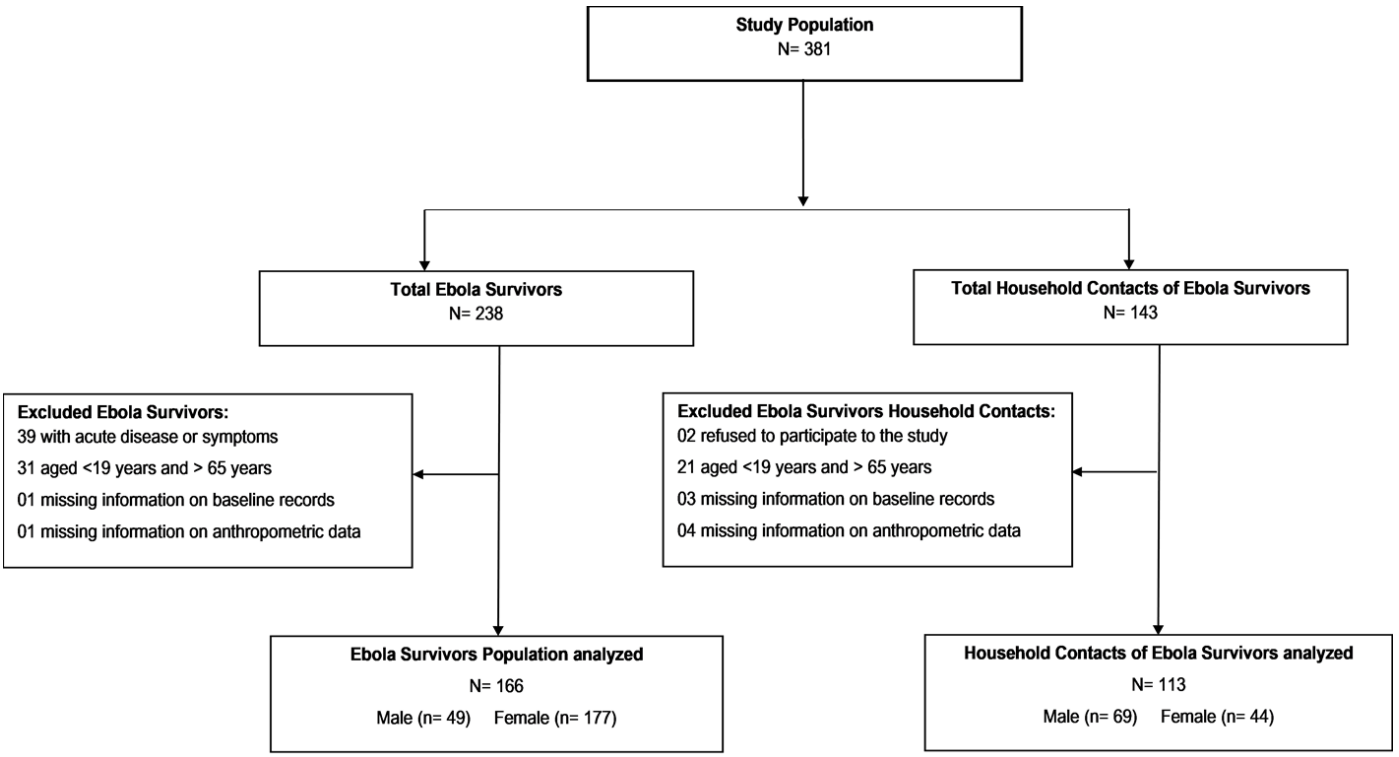

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Table 1: Baseline socio-demographic characteristic of Ebola survivors (n=166) ^.

Characteristic	Distribution
Age at baseline, y	34.5 ± 9.9
Age at the time of the present study, y	37.5 ± 10
Duration at ETU, d	29.4 ± 21.5
The time between ETU release and enrolment in the present study, d	540.6 ± 178.2
Age group, y	
19 – 34	94 (56.6)
35 – 50	60 (36.1)
51 – 65	12 (7.2)
Gender	
Male	49 (29.5)
Female	117 (70.5)
Marital Status	
Single	60 (36.1)
Married	103 (62)
Widow/widower	3 (1.8)
District of residence	
Bombali	26 (15.7)
Port Loko	60 (36.1)
Western Rural	30 (18)
Western Urban	48 (28.9)
Not recorded	2 (1.2)
ETC/EHC of treatment	
ADRA, Freetown	1 (0.6)
Arab Hospital, Makeni	1 (0.6)
Connaught Hospital	1 (0.6)
Emergency, Goderich	1 (0.6)
Hasting, Freetown	22 (13.2)
IMC, Mateneh	7 (4.2)
IMC, Port Loko	5 (3)
Jui Hospital, Freetown	1 (0.6)
Kenema Gov. Hospital, Kenema	3 (1.8)
Kerry Town, Freetown	9 (5.4)
Magbenteh Hospital, Makeni	2 (1.2)
MH34, Freetown	4 (2.4)
MSF Bo	11 (6.6)
MSF Kalaihun	14 (8.4)
Port Loko Gov. Hospital, Port Loko	25 (15)
Red Cross, Kenema	2 (1.2)
Red Cross, Port Loko	13 (7.8)

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Not recorded	44(26.5)

^ETC: Ebola Treatment Centre; EHU: Ebola Holding Centre; IMC: International Medical Corps; Red Cross: The International Federation of Red Cross and Red Crescent Societies; ADRA: The Adventist Development and Relief Agency; MSF: "Médecins sans Frontieres" Doctors without borders; MH34: 34th Regimental Military Hospital. ^Values are given as mean ± SD or number (percentage); y = year; d = day.

Table 2: Prevalence of symptoms related to nutritional sequelae among survivors presenting post-Ebola syndrome and their household contacts at baseline visit to the clinic.

Clinical Sequelae	**Ebola Survivors** (n=166) ^	**Household Contacts** (n=113) ^	***p-value***
Loss of appetite	69 (41.6)	30(26.5)	*.01**
Nausea or vomiting	63 (37.9)	02(1.8)	*<.001**
Diarrhoea	72 (43.4)	34(30.1)	*.025**
Sore throat or pain with swallowing	43 (25.9)	14(12.4)	*.006**
Hiccups	36 (21.7)	00(0.0)	*<.001**
Constipation	10 (6)	00(0.0)	*.008**

*^Values are given as a number (percentage), * significantly different between both groups .05*

Table 3: Comparison of anthropometric parameters between household contacts and Ebola survivors presenting post-Ebola syndrome.

^Ebola Survivors (n=166)			**Household Contacts** (n=113)			
Male	Female	$\bar{x} \pm SD$	Male	Female	$\bar{x} \pm SD$	*-value*

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Weight	65.04±8.41	63.35±13.49	*63.84±12.24*	65.89±8.84	68.86±19.45	*67.05±14.04*	*.023**
Height	1.70±0.07	1.57±0.09	*1.61±0.11*	1.73±0.08	1.63±0.07	*1.69±0.09*	*<.001**
BMI	22.48±2.74	25.66±5.26	*24.72±4.88*	21.93±2.92	25.87±7.18	*23.47±5.38*	*.004**

*^Values are given as mean ± SD; Weight in Kg; Height in m; BMI = Body Mass Index in Kg/m^2; p-value obtained using Mann-Whitney U-test based on homogeneity of variance assessed using Levine's test of equality of variance; * mean value Significant different between both groups at .05 (2-tailed).*

Table 4: Relationship between Body Mass Index category and gender of Ebola survivors (n=166).

		BMI Category				Total
		Underweight	Normal	Overweight	Obesity	
Gender ^	Female	4	51	42	20	117
		3.4%	43.6%	35.9%	17.1%	100%
	Male	4	35	9	1	49
		8.2%	71.4%	18.4%	2%	100%
Total		8	86	51	21	166
		4.8%	51.8%	30.7%	12.6%	100%

^Values are given for each gender type as count and associated percentage; BMI = Body Mass Index; Underweight =BMI <18.5; Normal =BMI 18.5 – 24.9; Overweight =BMI 25.0 – 29.9; Obesity = 30.0 and over; $x^2 = 16.420$; df =3; p = .001; Cramer's V =. 315.

Table 5: Relationship between Body Mass Index category and age group of Ebola survivors (n=166).

		BMI Category				Total
		Underweight	Normal	Overweight	Obesity	
Age group	19 – 34	6	56	27	5	94
		6.4%	59.6%	28.7%	5.3%	100%
	35 – 50	1	26	19	14	60
		1.7%	43.3%	31.7%	23.3%	100%
	51 – 65	1	4	5	2	12
		8.3%	33.3%	41.7%	16.7%	100%

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^					
Total	8	86	51	21	166
	4.8%	51.8%	30.7%	12.6%	100%

^Values are given for each age group as count and associated percentage; BMI = Body Mass Index; Underweight =BMI <18.5; Normal =BMI 18.5 – 24.9; Overweight =BMI 25.0 – 29.9; Obesity = 30.0 and over; Likelihood ratio $x^2 = 15.317$; df =6; p = .018.

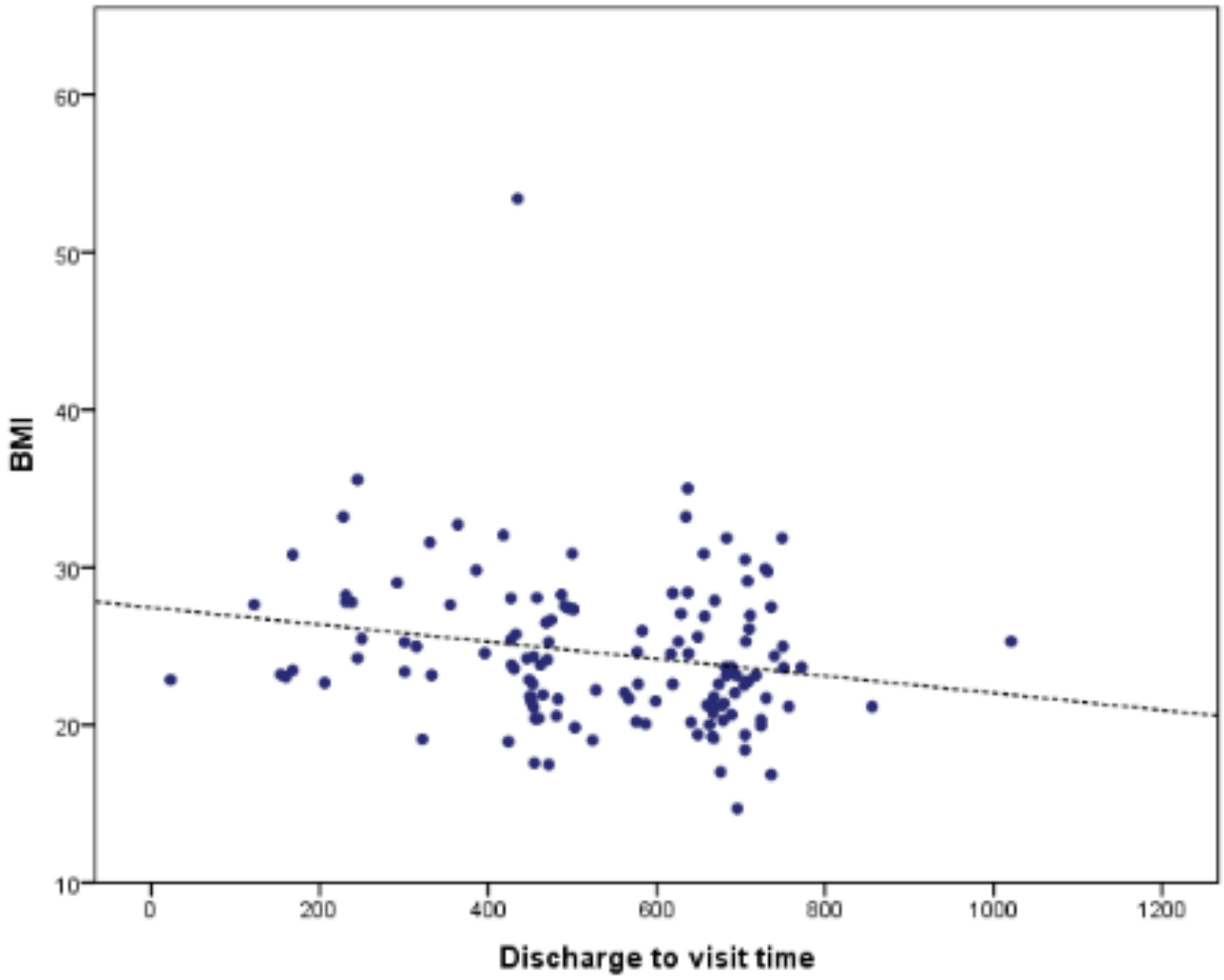

Figure 2: Scatter plot showing the low negative correlation (r = -.203) between discharge to baseline visit and Body Mass Index of EVD survivors.

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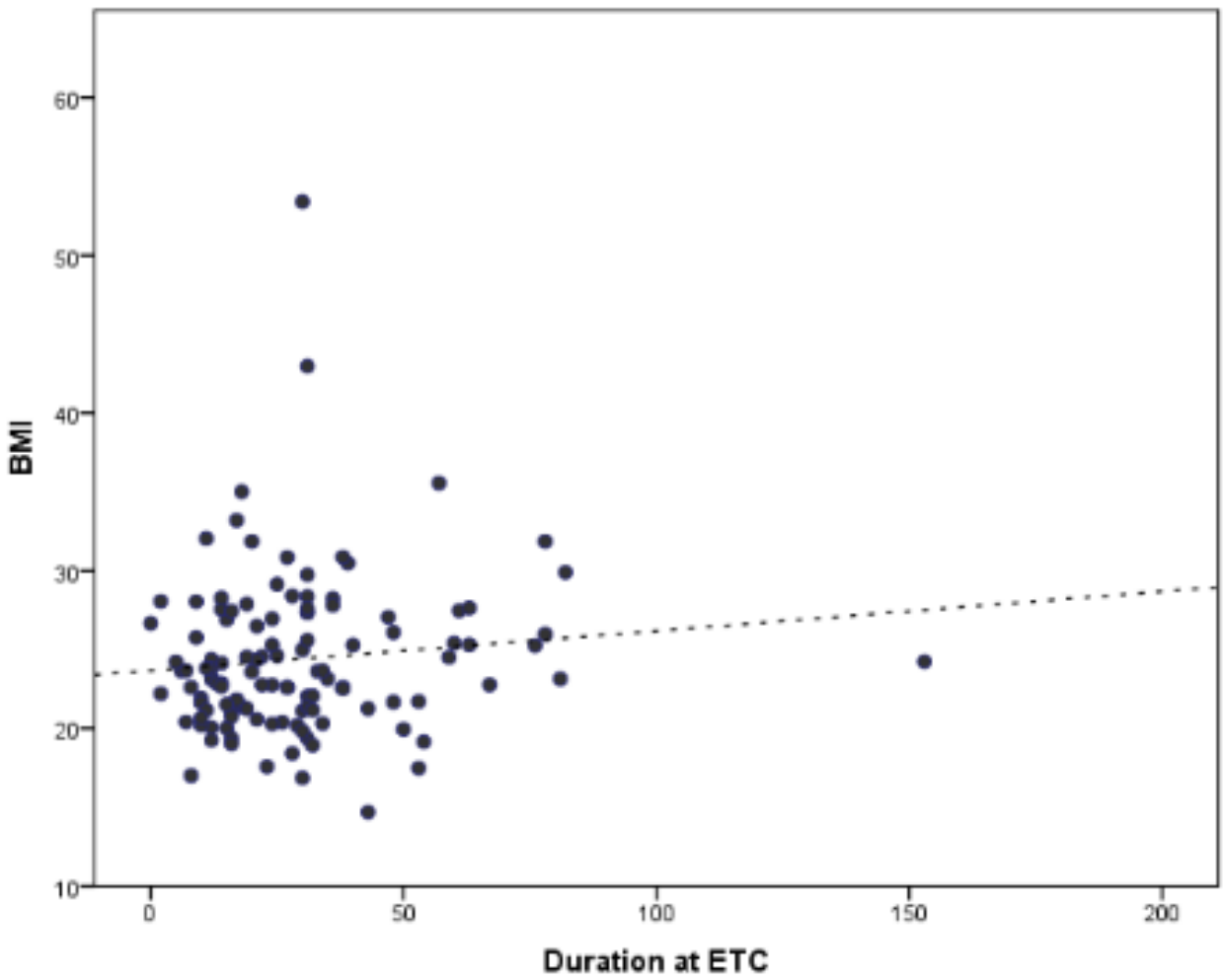

Figure 3: Scatter plot showing the low positive correlation (r = .107) between duration at the Ebola Treatment Centre and Body Mass Index of Ebola survivors.

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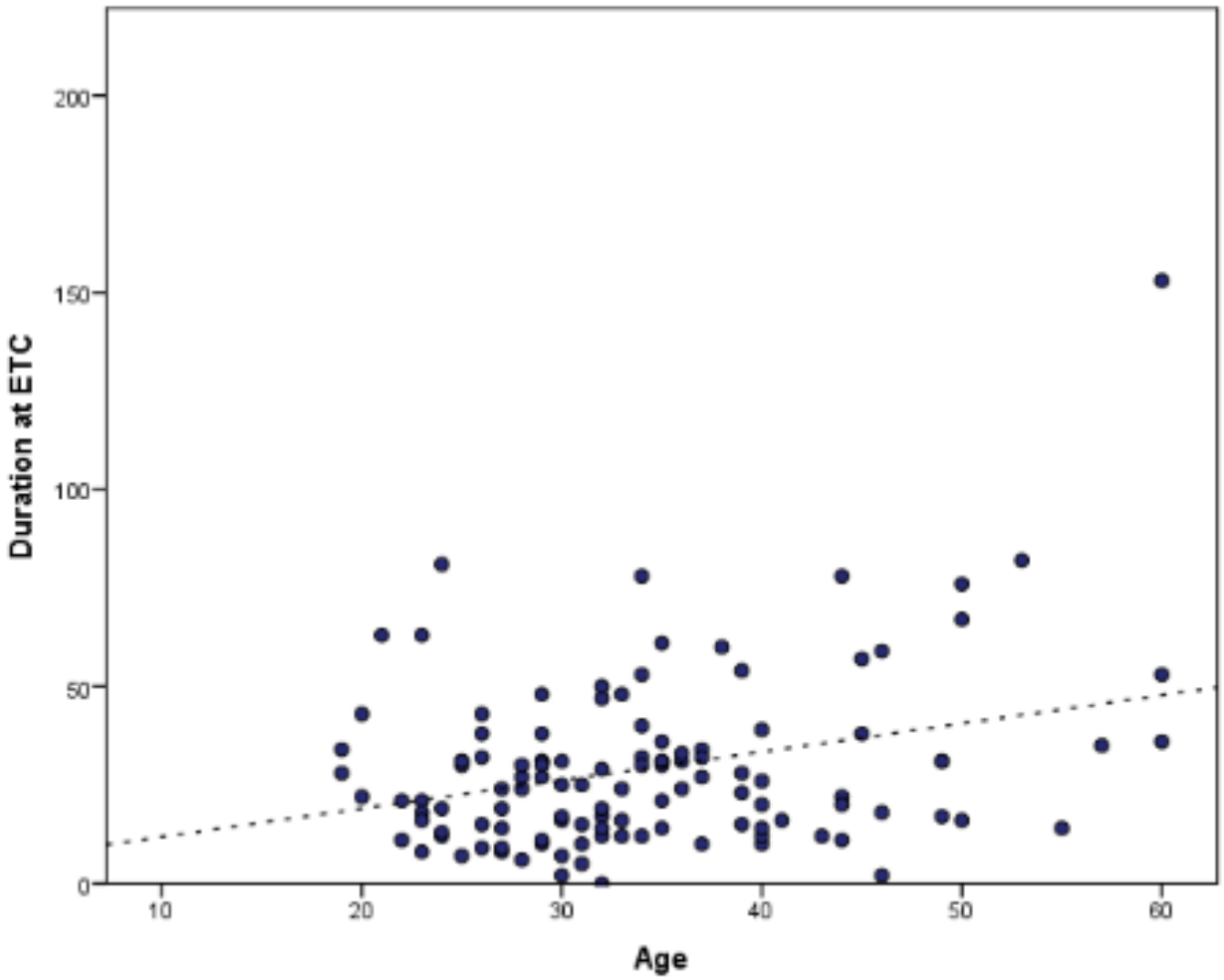

Figure 4: Scatter plot showing the low positive correlation (r = .310) between the age of EVD survivors and duration at the Ebola Treatment Unit.

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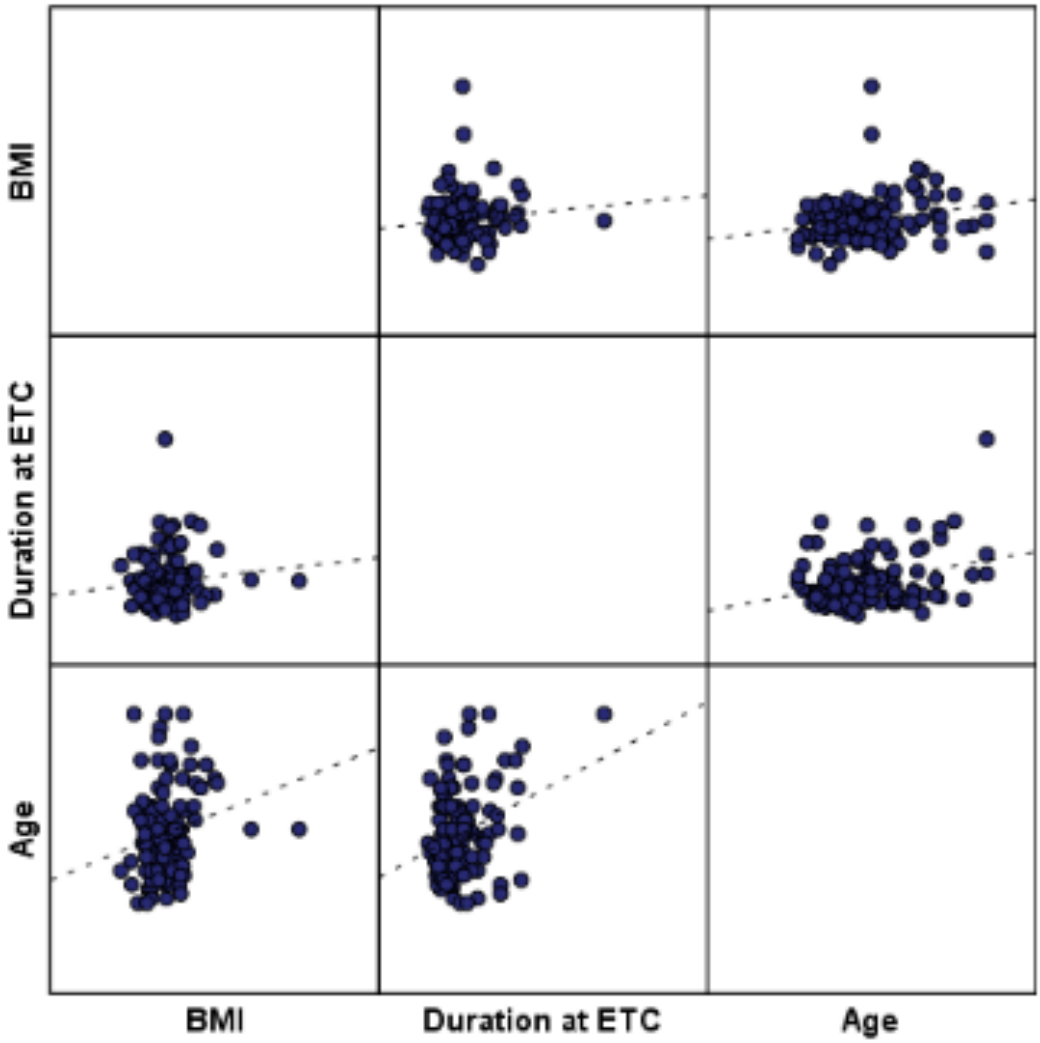

Figure 5: Pearson product-moment graph showing a correlation between age, duration at ETU and body mass index of Ebola survivors.

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Table 6: Binary logistic regression analysis for the association between each independent predictor and survivors' likelihood of developing nutritional sequelae.

	Nutritional Sequelae																	
	Loss of Appetite **χ2[5] = 7.69, p > .05*			**Nausea or vomiting** *χ2[5] = 11.69, p = .039*			**Diarrhoea** *χ2[5] = 3.89, p > .05*			**Sore throat/Pain in Swallowing** *χ2[5] = 8.88, p > .05*			**Hiccups** *χ2[5] = 6.68, p > .05*			**Constipation** *χ2[5] = 4.89, p > .05*		
Predictor	*β (SE)*	*P*	*OR, 95% C.I.*	*β (SE)*	*p*	*OR 95% C.I.*	*β (SE)*	*p*	*OR 95% C.I.*	*β (SE)*	*p*	*OR 95% C.I.*	*β (SE)*	*P*	*OR 95% C.I.*	*β (SE)*	*p*	*OR 95% C.I.*
Age	-.014 (.017)	*.41*	.99 .95 – 1.02	.010 (.018)	*.57*	1.01 .98 – 1.05	-.006 (.017)	*.72*	.99 .96 – 1.02	-.018 (.019)	*.33*	.98 .95 – 1.01	-.029 (.020)	.13	.97 .93 – 1.00	.029 (.038)	.46	1.03 .95 – 1.11
Gender	-.71 (.38)	*.066*	.49 .22 – 1.04	-1.14 (.42)	*.006*	3.19 .14 – .72	-.63 (.38)	*.094*	.53 .26 – 1.11	-.64 (.46)	*.17*	.53 .21 – 1.3	-.91 (.51)	.07	.40 .15 – 1.09	.76 (.70)	.28	2.13 .54 – 8.42
Marital Status	.17 (.34)	*.62*	1.18, .61 – 2.3	.15 (.35)	*.66*	1.16 .59 – 2.28	-.22 (.33)	*.49*	.80 .41 – 1.53	-.08 (.38)	*.82*	.92 .44 – 1.94	-.15 (.39)	.71	.86 .39 – 1.87	.44 (.75)	.56	1.56 .36 – 6.80
Duration at ETU	.003 (.009)	*.71*	1.00 .99 – 1.02	.011 (.011)	*.29*	1.01 .99 – 1.03	.00 (.009)	*.97*	1.0 .98 – 1.02	-.01 (.01)	*.29*	.99 .97 – 1.0	-.002 (.010)	.86	.99 .98 – 1.02	-.024 (.015)	.10	.98 .95 – 1.01
Nutritional Status (BMI)	-.037 (.035)	*.29*	.96 .89 – 1.03	-.015 (.035)	*.66*	.99 .919 – 1.06	.006 (.034)	*.87*	1.0 .94 – 1.07	-.048 (.037)	*.20*	.95 .88 – 1.03	.005 (.040)	.89	1.01 .93 – 1.09	.051 (.09)	.57	1.05 .88 – 1.25

** Overall model based on the Omnibus Tests of Model Coefficients.*

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