*Full Length Research Article*

# Main causes of noncommunicable diseases in Guinea: a study in medical students of the University of Conakry

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The aim of this study was to evaluate the main risk factors of noncommunicable diseases including BMI, unbalanced diet, physical inactivity, tobacco and alcohol use in young Guinean adults population. The research was carried out in 2015 and concerned 1047 students currently enrolled between 1st and 6th year of study at the medical faculty of the University of Conakry. The high response rate (92.7%) allowed analyzing a total of 970 usable surveys (624 men and 346 women, average age: 22.5 years ± 2.7 SD). The anonymous questionnaire was self-reported and the height and weight measurements were made during the lab courses in the presence of the investigators. With a sport rate less than 3 times per week or walked distances below 5 km per day, 63.6% of the surveyed students seemed leading a sedentary lifestyle. The majority of them (70.5%) had a healthy weight (BMI situated between 18.5 and 25 kg/m$^2$). Nevertheless, 10.6% were overweight and 3.2% were suffering from obesity. Overweight and obesity were much higher among women: 16.8% and 7.2% (7.2% and 1.0% for men). Thus, 36.5% were not satisfied by their corpulence (31.7% in men and 45.3% in women). The main risk factor of noncommunicable diseases in this population is the lack of physical activity. Other risk factors, such as unbalanced diet, overweight, tobacco and alcohol use, are also present, but their involvement appears to be less important or nonexistent.

## INTRODUCTION

According to the World Health Organization (WHO), the noncommunicable diseases (NCDs) are the leading causes of mortality in the World and their main risk factors are high blood pressure (responsible for 13% of deaths globally), tobacco use (9%), high blood glucose (6%), physical inactivity (6%), obesity (5%) and harmful alcohol use (5%) (World Health Organization, 2009). Historically, NCDs were associated with the economic development and were considered as"diseases of the rich" (Boutayeb and Boutayeb, 2005). Henceforth, this phenomenon affects countries across all income groups: high, middle and low (World Health Organization,

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2018). However, their burden in low- and middle-income countries has increased with an estimated 80% of the four main types of NCDs: cardiovascular diseases, diabetes, cancers, and chronic pulmonary diseases, respectively. Most of the time, these chronic diseases affect people at economically and socially productive age (World Health Organization, 2005; World Health Organization, 2008). Thus, 53.8% of all deaths in low- and middle-income countries are attributed to noncommunicable diseases and only 36.4% to communicable diseases (Lopez et al., 2006).

Nowadays, NCDs constitute a significant concern in West Africa (Baingana and Bos, 2006; Zabsonré et al., 2000). The explanation for this rise is mostly an extrapolation from the history of high-income countries whose experience differed from the development processes affecting today's low- and middle-income countries (Miranda et al., 2008). Indeed, in the high-income countries the rise of NCDs was followed by the lowering of communicable diseases (CDs). Thereby, in these countries take place a real epidemiological transition from CDs to NCDs, as opposed to low- and middle-income countries in which "diseases of the rich" converge to "diseases of poverty", such as tuberculosis, HIV/AIDS and other infectious and parasitic diseases (Remais et al., 2013). The common realities of today's low- and middle-income countries are marked by increased urbanization with high level of urban poverty. Consequently, the low- and middle-income countries are now facing the increasing of noncommunicable diseases, as well as communicable diseases (Yusuf et al., 2001; Reddy, 2004; Perel et al., 2006). In addition, when poverty, malnutrition, unsanitary conditions and infections are still prevalent, the context contributes to long-term risk of rising of the NCDs. This situation has the potential to overstretch already strained health systems (Mandy and Nyirenda, 2018).

Nevertheless, the NCDs are considered as "lifestyle" diseases, because the majority of them are preventable (Cadwell, 2012). The major lifestyle risks are unhealthy diets, physical inactivity, overweight, tobacco use and harmful use of alcohol (World Health Organization, 2014). Lifestyle changes have been shown to significantly reduce morbidity and mortality rates for most of the chronic diseases. It seems to be a "low-cost" solution to reduce the modifiable risk factors (World Health Organization, 2017). Indeed, in recent decades, NCDs tend to "rejuvenate" not only in Western countries but also in developing countries. The prevalence of lifestyle diseases is increasing also among students (Nagheer et al., 2017; Macedo et al., 2014). It is well known that youth is the most important period in order to promote healthy lifestyle. Although most of young people understand the importance of healthy lifestyle, but many of them are not ready to change their behaviour (McAndrews et al., 2011). In this regard, a study in medical students is of particular interest: most of them are going to become medical doctors promoting healthy lifestyle among their patients. That is why in our present investigation, we studied the lifestyle's risks of NCDs especially in this population.

Situated in West Africa, Guinea is exposed to all above-listed unfavourable medical factors. With a population of 12.6 million (according to World Bank estimates in 2016), Guinea takes the 180th place on the list of GDP per capita among 190 countries (List of Countries by Projected GDP per capital, 2017). Poverty affected about 55% of Guinea's population in 2012 and this percentage increased because of the Ebola crisis in 2014 and 2015 (Guinea Overview - World Bank Group). Hunger also poses a serious threat, with 17.5 % of the population experiencing food insecurity (Causes of Poverty in Guinea. The Borgen Project (2017)). Always faced with HIV/AIDS, malaria, tuberculosis and cholera, Guinea is now facing new medical threats related to changes in lifestyle such as physical inactivity and unbalanced diet. In Guinea, the investigations on the risk factors of NCDs are incomplete and probably underestimate the extent of the phenomenon. For example, a first survey on the prevalence of diabetes and its risk factors seem to confirm the extent of the problem and the disparities between urban and rural areas. The second survey was done through WHO STEPS protocol in 2009 in Lower Guinea including Conakry (Baldé et al., 2007). This study revealed high prevalence of some risk factors of NCDs such as smoking tobacco, unbalanced diet, overweight and low physical activity.

In our present investigation, we studied the young urban Guinean population. Based on the above, we believe that the lifestyle of young adults living in the capital is evolving, so that this category may develop NCDs over time. The aim of this study was, therefore, to evaluate the main risk factors of NCDs including, BMI, unbalanced diet, physical inactivity, tobacco and alcohol use in young adults, represented by medical students at the University of Conakry.

**METHODS**

The study was carried out in June 2015 and concerned 1047 students currently enrolled between 1st and 6th year of study at the medical faculty of the University of Conakry. The high response rate (92.65%) allowed analyzing a total of 970 usable surveys (624 men and 346 women). The average age of the participants was 22.5 years (± 2.7SD) and its minimum and maximum values were situated between 17 and 37 years (Table 1).

**Table 1.** Survey sample according to the age and the sex

| Age | 17 - 20 | 21 - 22 | 23 - 24 | 25 - 26 | 27 - 28 | 29 and more | Total |
|---|---|---|---|---|---|---|---|
| **Men** | **111** | **167** | **156** | **117** | **48** | **25** | **624** |
| | 17,8% | 26,8% | 25,0% | 18,8% | 7,7% | 4,0% | 100,0% |
| | 44,0% | 62,8% | 69,6% | 79,1% | 87,3% | 100,0% | 64,3% |
| **Women** | **141** | **99** | **68** | **31** | **7** | **0** | **346** |
| | 40,8% | 28,6% | 19,7% | 9,0% | 2,0% | 0,0% | 100,0% |
| | 56,0% | 37,2% | 30,4% | 20,9% | 12,7% | 0,0% | 35,7% |
| **Total** | **252** | **266** | **224** | **148** | **55** | **25** | **970** |
| | 26,0% | 27,4% | 23,1% | 15,3% | 5,7% | 2,6% | 100,0% |
| | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

The questionnaire contained 22 open-ended and closed-ended questions grouped into eight (8) items such as **general data** (sex, age, place of birth and nationality), **self-reported medical problems** (chronic diseases, malformations and medical treatments), **addictions** (tobacco and alcohol consumption), **diabetes family history** (type 2 diabetes reported in family and parents), **living conditions** (housing, income and family situation), **diet** (based on the week-food intake), **physical activity** (walking distance and sporting activities), and **physical self-concept** (perception of its corpulence). The questionnaire allowed us to explore a great number of information, such as demographic, socioeconomic, anthropometric and medical data. Thus, we used only the most important and useful for our study, particularly in relation to noncommunicable diseases risk factors. The questionnaire was anonymous and self-reported by the participants. The height and weight measurements were made during the physiology lab courses in the presence of the investigators.

Considering the characteristics of the sample (young and active population) the Body Mass Index was categorized into four standard intervals: underweight (below 18.5 kg/m$^2$), normal weight (between 18.5 and less than 25 kg/m$^2$), overweight (between 25 and less than 30 kg/m²) and obesity (over 30 kg/m²). The daily walking perimeter was estimated individually using the detailed map of Conakry or taking into account the average walking time. All statistical analyzes were carried out with the SPAD 5.5 software. From an ethical stand point, we got the approval for Scientific Committee of University of Conakry and consent has been obtained from each subject after full explanation of the purpose and nature of all procedures used.

## RESULTS

The collected data showed that 79.6% of surveyed students had Guinean nationality and came from the capital Conakry (22%) or from one of the four geographical regions: Forest Guinea (18.7%), Lower Guinea (14.5%), Middle Guinea (13.1%) and Upper Guinea (11.3%). A fifth of the students (20.4%) was foreign and came mainly from the neighboring countries such as Mali (8.9%), Ivory Coast (6.1%), Cameroon (3.4%) and Mauritania (1.6%). The majority (65.7%) lived with parents or relatives, 28.4% lived alone and 5.9% lived in couples. More than 99% lived through family support and partly through the scholarship. Less than 1% had its own income. Among the parental professions, the employees represented 30.5%, 27.5% were executives and 27.2% were entrepreneurs (traders, artisans and others). Thus, 85% of respondents came from relatively wealthy families. Farmers and workers constituted, respectively, only 10.8% and 2.3%, respectively.

The majority (80%) of the surveyed students did not show any obvious diseases or disabilities. One fifth (20%) reported health problems, among them more than half (51.1%) declared occasional gastrointestinal disorders (diarrhea or constipation), 21.2% respiratory disorders (asthma), 17.1% motor disorders (post-poliomyelitis syndrome essentially), 8.3% of visual disturbances (mainly myopia) and 2.3% cardiovascular disorders (undetermined). Apart from some acute diseases, the main treatments used by the participants were anti-inflammatory drugs or pain killers (Ventolin for asthma). Among respondents, no cases of diabetes have been reported. Nevertheless, 22.2% revealed cases of diabetes in their families including 10.1% among first-degree relatives (parents, brothers and sisters). Health risks related to tobacco and alcohol addictions were very low in men and in existent in woman. Only 4.1% of men declared using tobacco and 7.8% of them declared using alcohol occasionally (once per week and less) but never in a harmful way (according to public health in France, not more than two standard drinks per day and not more than ten drinks per week).

The continuous variables analysis has shed light on some anthropometric parameters in this population. Thus, the average height in men was 173.05cm (± 3.6 SD) and 162.40cm (± 2.4 SD) in women. The average mass in men was 62.97kg (± 5.1 SD) and 59.68 (± 4.8 SD) in women. However, the majority of them (70.5%) had a healthy weight (BMI situated between 18.5 and 25 kg/m$^2$). Underweight concerned 15.6% of respondents.

Their proportion was almost identical between men and women (15.4% and 16.2%). No case of extreme thinness had been reported. Otherwise, 10.6% were overweight and 3.2% were suffering from obesity. Overweight and obesity were more common among women: 16.8% and 7.2% (7.2% and 1.0% for men, respectively). Cases of morbid obesity (BMI > 40) were not observed (Table 2 ).

**Table 2.** BMI by sex

| BMI Sex | Under weight | Normal weight | Over weight | Obesity | Total |
|---|---|---|---|---|---|
| **Men** | **96** | **477** | **45** | **6** | **624** |
| | 15,4% | 76,4% | 7,2% | 1,0% | 100,0% |
| | 65,4% | 69,7% | 43,7% | 19,4% | 64,3% |
| **Women** | **56** | **207** | **58** | **25** | **346** |
| | 16,2% | 59,8% | 16,8% | 7,2% | 100,0% |
| | 34,6% | 30,3% | 56,3% | 80,6% | 35,7% |
| **Total** | **152** | **684** | **103** | **31** | **970** |
| | 15,6% | 70,5% | 10,6% | 3,2% | 100,0% |
| | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

Before our study, the majority of respondents (69.1%) did not know their height, weight and BMI. Thus, some of them had a wrong perception of their corpulence (from a medical point of view). Indeed, 29.1% of respondents with normal BMI considered themselves, underweight. From 31.8% of students who declared feeling themselves underweight, only a third (32.7%) really was (Table 3).

**Table 3.** BMI and self-perception of the body weight

| BMI Self perception | Under weight | Normal weight | Over weight | Obesity | Total |
|---|---|---|---|---|---|
| **under weight** | **101** | **199** | **6** | **3** | **309** |
| | 32,7% | 65,2% | 1,7% | 0,3% | 100,0% |
| | 66,2% | 29,1% | 5,9% | 9,7% | 31,8% |
| **normal weight** | **51** | **455** | **63** | **4** | **573** |
| | 8,9% | 79,4% | 11,0% | 0,7% | 100,0% |
| | 33,8% | 66,5% | 61,2% | 12,9% | 59,1% |
| **over weight** | **0** | **30** | **34** | **24** | **88** |
| | 0,0% | 34,1% | 38,6% | 27,3% | 100,0% |
| | 0,0% | 4,4% | 33,0% | 77,4% | 9,1% |
| **Total** | **152** | **684** | **103** | **31** | **970** |
| | 14,0% | 70,5% | 10,6% | 3,2% | 100,0% |
| | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

Moreover, 36.5% of respondents were not satisfied with their corpulence (31.7% in men and 45.3%in women). Among them, 27.9% would have liked losing weight (13.3% in men and 47.4% in woman) and 72.1% conversely gaining weight (86.7% in men and 52.6% in woman).

From a nutritional point of view, more than half of respondents (56.3%) reported taking three meals a day, 39.8% two meals and 3.9% only one, respectively. The vast majority (86.3%) ate meals cooked within their family, against 13.7% who recurred to "fast food". Food rations are composed of the major food groups. However, their frequencies in meals were very variable. For almost all students, cereals (mainly rice and starches) were the basis of the diet. Three-quarters (75.4%) consumed animal protein every day (mostly fish), 19.8% only three times a week and 4.5% only once a week. Dairy consumption was also very uneven: daily for 30.3% of respondents, three times weekly for 30.4% and weekly for 24%. The lipids were consumed daily by 87.3% of students essentially in the form of vegetable oils. Fruits and vegetables were present in the daily ration for 35.7% of respondents. Some 35.4% consumed them every two days, 24.3% once a week and 4.5% even more rarely. Nevertheless, 85% of the surveyed students considered their nutrition as "proper or satisfying".

Almost none of the surveyed students had an employment and the only energy was needed for everyday life movementsand in some cases for sports activities. Over 80% of them rate their daily walked distance to less than 5 km, in other words less than an hour of walking per day. Moreover, this rate is stronger in students who didn't practice any sports. Thus, 67.2% of students who didn't practice any sports walked less than 3 km per day (Table 4).

**Table 4.** Walking perimeter and sporting activity

| Walking perimeter Sporting activities | 3km and less | 4 km | 5 km | 6km and more | Total |
|---|---|---|---|---|---|
| **No** | **350** | **109** | **36** | **26** | **521** |
| | 67,2% | 20,9% | 6,9% | 5% | 100,0% |
| | 61,3% | 50,7% | 38,3% | 29,8% | 53,7% |
| **Yes** | **221** | **106** | **58** | **64** | **449** |
| | 49,2% | 23,6% | 12,9% | 14,2% | 100,0% |
| | 38,7% | 49,3% | 61,7% | 70,2% | 46,3% |
| **Total** | **571** | **215** | **94** | **90** | **970** |
| | 58,9% | 22,2% | 9,7% | 9.3% | 100,0% |
| | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

In addition, women reported having a significantly lower walking perimeter than men. The vast majority of them (73.4%) walked less than 3 km per day, 17.3% less than 4 km per day (50.8% and 24.8% in men, respectively).

Only 46.3% compensated the lack of physical activity by one or more sport activities in the following frequency: 1 time per day (15.4%), 3 times per week (37.9%), once per week (43.3%) and once per month (3.3%) (Table 5).

**Table 5.** Walking perimeter and sport frequency

| Walking perimeter / Sport frequency | 3 km and less | 4 km | 5 km | 6 km and more | Total |
|---|---|---|---|---|---|
| **1 time per day** | **28** | **13** | **12** | **16** | **69** |
| | 40,6% | 18,8% | 17,4% | 23,2% | 100,0% |
| | 12,7% | 12,3% | 21,1% | 23,7% | 15,4% |
| **3 times per week** | **77** | **51** | **18** | **24** | **170** |
| | 45,3% | 30,0% | 10,6% | 14,1% | 100,0% |
| | 34,8% | 48,1% | 31,6% | 39,0% | 37,9% |
| **1 time per week** | **106** | **40** | **26** | **22** | **194** |
| | 54,6% | 20,6% | 13,4% | 11,3% | 100,0% |
| | 48,0% | 37,7% | 45,6% | 33,9% | 43,3% |
| **1 time per month** | **10** | **2** | **1** | **2** | **15** |
| | 66,7% | 13,3% | 6,7% | 13,3% | 100,0% |
| | 4,5% | 1,9% | 1,8% | 3,4% | 3,3% |
| **Total** | **221** | **106** | **57** | **569** | **448** |
| | 49,3% | 23,7% | 12,7% | 14,3% | 100,0% |
| | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

It means that in addition to the 459 students who walked less than 5 km per day and who did not practice any sports, we must add 158 students who also walked less than 5 km per day and practice sports one time per week or less. In other words, 63.6% of all surveyed students led a sedentary lifestyle.

For students who did not practice any sports (53.7% of the sample), the forbearance reasons were numerous and varied: lack of time (67.5%), uselessness (25.1%) and medical problems (7.1%). Especially, men evoked the lack of time (80.1%), while women considered sports more often useless (35.2%). Medical reasons or contraindications were mentioned with the same frequency in both sexes. The proportion of "non-athletes" largely predominated among women (83.5% against 37.2% for men).

Regarding sports, football dominated all categories with 59.6%. It was essentially matches played on open spaces without any supervision. Running, fitness and team sports (basketball and volleyball) were practiced by 18.5%, 10.3% and 7.1%, respectively. Other sports were very rare and the practice rate was insignificant (4.5%).

**CONCLUSION**

In this study, we collected data on the main risk factors of noncommunicable diseases in young Guinean urban adults represented by medical students at the University of Conakry. Because of its size (n = 970) and diversity (age, sex, study level, place of birth), this sample is particularly representative of all medical students and in a certain way ofall students of the University of Conakry. The results brought us a lot of new information on their living conditions, health status, BMI, diet, walking perimeter and sports practice. Nevertheless, some of our data are rather approximate and give an overview rather than specific facts. The use of a pedometer or a GPS could, for example, allow estimating much more precisely the walking perimeter. The more individualized data in term of duration and intensity of the effort could give more precision on the parameters of sporting activities. The more detailed study of the food rations could better target the dietary deficiency if it really exists. Finally, qualitative data, particularly interviews, could shed more light on the influence of the cultural and social context on the behaviour of this population. At the same time, some of these research methods cannot be applied to a sample as large as ours.

Despite these few limits, the results of our study show that the main risk factor of noncommunicable diseasesin this population is a lack of physical activity. Indeed, 63.6% of all surveyed students led a sedentary lifestyle and a quarter of them manifested a lack of interest toward physical activity. With a sport rate less than 3 times per week or walked distances below 5 km per day, the level of energy expenditure of the majority of respondents appears to be under the physiological norms. According to the different epidemiological studies, in order to stay healthy, the minimum physical activity for an adult should be situated around thirty minutes of brisk walking per day or a minimum effort of 10,000 daily steps (6 to 7 km). Below this threshold, the subject risks developing a noncommunicable disease such as Type 2 diabetes (World Health Organization, 2004). A large number of studies have shown that lower physical activity is pandemic especially among younger adults and one of leading cause of mortality in the world (Bauman et al., 2009; Kohl et al., 2012). Our study on Guinean students confirms this concern.

Other risk factors are also present in this population, but their involvement appears to be less or non-existent.

Thus, from a nutritional standpoint, the consumption of dairy products, fruits and vegetables is well below international recommendations. For example, the "French National Nutrition and Health Program" recommends daily consumption of at least five different fruits and vegetables, and three dairy products. In our study, almost all of the respondents consume dairy products, vegetables and fruits only once to three times a week, and rice and starches are the basis of their diet. This scenario reflects an imbalance between "fast" sugars and fiber that may lead to some noncommunicable diseases such as Type 2 diabetes (Ministry of Health, French National Nutrition and Health Program 2011-2015).

Overweight as an additional risk factor can be attributed to physical inactivity and unbalanced diet. Thus, 10.6% of surveyed students were overweight and 3.2% were suffering from obesity. Overweight and obesity were much higher among women: 16.8% and 7.2% (7.2% and 1.0% for men, respectively). In addition, our results regarding women are comparable with the study on the prevalence of overweight/obesity among university students from 22 low- and middle-income countries (Peltzer et al., 2014). Moreover, the representations of an "ideal body"according to the surveyed students tend towards more corpulent bodies. On the one hand it probably results from an under valuation of the real weight compared to BMI. Thus, 34.1% with a normal BMI considered themselves underweight, and the majority (72.1%) wishing gaining weight (86.7% in men and 52.6% in woman). On the other hand, traditions and local culture consider overweight to be a sign of health and wealth (Correia et al., 2014).

There are no sufficient data on tobacco and alcohol use and its consequences in many developing countries including Guinea. In our sample, the consumption of tobacco and alcohol was very low among men and practically absent by women. For comparison, the studies conducted among high school students in certain African countries reported that in different establishments, consumption of alcohol varied from 9% to 55% in Ethiopia, 15% in Kenya and 40 % in South Africa (Yismaw and Kebede, 2015; Kuria, 1996; Odek-Ogunde and Pande-Leak, 1999). Thereby, comparatively to other developing countries, tobacco and alcohol risk is rather low in our student population. It can be explained by the characteristics of the sample: young adults mostly from wealthy families and representing intellectual elite of Guinean youth (reflecting in the same time the elitist character of the medical higher education in Guinea). Otherwise, the consumption of these two products is prohibited by Islam, the main religion of the country with more than 80% of practitioners. Among other information revealed by our study we can note that 4.2% of respondents reported suffering from asthma. This rate is much lower than one reported by WHO in Western countries and especially in North America, but it seems to be in line with data available in West Africa (Scrivener and Britton, 2014). We did not found any data on Guinea. Among other health problems, 1.7% evoked visual disturbances and 3.4% suffered from the sequelae of poliomyelitis which are at the origin of their motor disability. This phenomenon largely results from an incomplete vaccination against this disease in the previous decades (Tchirkov et al., 2012).

In conclusion of this study, we can put forward the need of the development and supervision of physical and sports practices in students and particularly in future Guinean doctors. As mentioned in the introduction, the sedentary lifestyle has become a real risk factor for chronic diseases and is ravaging the developed Western countries. This phenomenon is globalizing and is increasingly affecting developing countries. Added to this, a food imbalance and the increase of other risk factors constitute for Africa and Guinea in particular, a real time bomb that will inevitably affect future generations. Physical education through regular sporting activities and healthy diet are the only way to delay or even overcome this danger. Thus, considerable investment in sports, like university sport in Europe or in North America (within the framework of the International University Sports Federation, for example), must be a real challenge for Guinean leaders.

This research, which concerned the field of sports medicine, epidemiology and sports sciences, shows that the sedentary lifestyle and the physical inactivity now affect low-income countries such as Guinea. Despite the presence of some high-level athletes and recognized footballers, mass sports, physical education and associative sporting activities remain at a very low level. In addition, the role of sporting activities as a means of maintaining good health, physical and functional rehabilitation, and treatment of certain chronical diseases such diabetes, hypertension and obesity, are absolutely under estimated and not studied at the Faculty of Medicine of Conakry. Thus, education through sport and democratization of sports practices should therefore constitute a basic foundation of health promotion and prevention. Finally, without really making any new fundamental advances in the field of sports medicine, our study shows the importance of its development in Guinea.

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