Cardiovascular Topics

Trends and outcomes of cardiovascular disease admissions in Lagos, Nigeria: a 16-year review

Amam C Mbakwem, Casmir Ezenwa Amadi, Jayne N Ajuluchukwu, Oyewole A Kushimo

Abstract

Background: Cardiovascular disease (CVD)-related admissions are on the increase in Nigeria and the rest of Africa. This study was carried out to highlight the burden, patterns and outcomes of CVD admissions in a tertiary hospital over a 16-year period in Lagos, Nigeria.

Methods: Admissions records of patients admitted into the medical wards within the study period (January 2002 to December 2017) were reviewed and relevant information pertaining to the study objectives was retrieved for analysis.

Results: There were a total of 21,369 medical admissions and 4,456 (20.8%) CVD-related admissions. A total of 3,582 medical deaths were recorded and 1,090 (30.4%) CVD-related deaths. The median age of the patients was 56.6 (46.0–68.0) years and 51.4% of these were males. Stroke, heart failure, hypertensive disease and acute coronary syndrome constituted 51.2, 36.2, 11.3 and 1.6% of all CVD admissions, respectively. There was a cumulative increase in the number of CVD admissions and deaths ($p < 0.001$, respectively) during the period under review.

Conclusion: CVD admissions are not only common in Nigeria, but there was also a temporal exponential increase in both the admission and death rates, most likely reflecting the epidemiological transition in Nigeria.

Keywords: CVD admissions, temporal patterns, stroke, heart failure

Cardiovascular disease (CVD), typified by stroke, coronary heart disease and heart failure, is a pre-eminent and preventable cause of death globally, accounting for an estimated 29% of all deaths. Over 80% of the global burden of CVD is borne by the low- and middle-income countries (LMICs). This burden of CVD is on a backdrop of the perennial high prevalence of infectious diseases and poverty-related morbidities and mortalities in these regions, constituting a double burden of disease profile. It is believed that by 2030, CVD and non-communicable diseases will be the dominant conditions in these countries.

The rising prevalence of CVD in these LMICs is fuelled by rapid urbanisation and westernisation and its corollary of globalisation of risks (unhealthy lifestyles): increased consumption of saturated fats and sugars, high salt intake, increasing physical inactivity, smoking and unhealthy use of alcohol. These unhealthy behaviours predispose to the development of biological risk factors for CVD, such as obesity, hypertension, diabetes and dyslipidaemia. The consequence is a rising burden of CVD.

In high-income countries (HIC), CVD remains the greatest contributor to mortality. However, the incidence has either plateaued or has assumed a downward trend over the past half century. This has been attributed to the success of public health policies and regulation to reduce exposure to a range of risk factors for CVD, improved medical management of these risk factors, opportunistic screening to detect asymptomatic disease, emergency care and treatment.

Data in the published literature show that CVD-related admissions are quite rife, constituting about 31% of all medical admissions in the USA, with ischaemic heart disease being the major cause of admission. In Saudi Arabia, CVDs constitute 34.4% of hospital admissions, with stroke being the leading cause. In Africa about one-tenth of all medical admissions are CVD related and stroke and heart failure are the major causes. In Nigeria, studies have shown that CVD-related admissions constitute about 20% of all medical admissions. However, these studies reviewed hospital admission records spanning a few years and did not demonstrate the temporal trends in these admissions and their outcomes. In essence there is limited knowledge of CVD burden and trajectories in Nigeria.

Lagos is cosmopolitan in outlook and a microcosm of Nigeria. It is the country’s economic hub and is home to over 17 million people, about 10% of the Nigerian population. Nigeria, like several countries in LMICs, is going through epidemiological transition characterised by the rising burden of non-communicable diseases, including CVD. There are anecdotal reports that CVD admissions are quite common in Lagos. An earlier study in the same hospital looking at hypertension-related emergency room (ER) deaths over a 20-year period showed that stroke and heart failure were the major contributors. However, their patterns, temporal trends and outcomes have not been well
characterised. Hence the necessity to study the pattern of CVD admissions and outcomes at the Lagos University Teaching Hospital, Nigeria, over a 16-year period.

Ethics approval (reference number: ADM/DCST/HREC/889) for the study was obtained from the Health Research ethics committee of the hospital.

Methods

This was a retrospective study and involved a review of admission records of all patients admitted into the medical wards of the 760-bed Lagos University Teaching Hospital, Nigeria, between January 2002 and December 2017. The medical wards contribute 116 (15.3%) of the total bed capacity of the hospital. All adult ward admissions are initiated through the adult ER of the hospital and the daily medical out-patient clinics. Patients presenting at the ER are reviewed first by the senior registrar on call while definitive diagnoses are made by the consultant, in line with the hospital policy. These patients are first stabilised in the ER and later transferred to the appropriate speciality wards for proper admission.

We reviewed all medical admissions and deaths in the ER and the four medical wards within the period under review. We used the records in the ER to trace the patients to their respective destination wards to avoid duplication of data. We also included patients who were admitted through the medical out-patient clinics that run from Monday to Friday. All patients who were admitted (first admissions and rehospitalisation) to the medical wards during the study period and whose records were documented in the admission and discharge/death registers were included.

Trained research assistants were used to retrieve vital information from the admission records/registers. Relevant patient information retrieved for analysis included date of admission, age, gender, initial diagnosis (presenting or admission diagnosis), final diagnosis, date of discharge/death and duration of hospital stay. The final diagnosis was used for computation.

In this study, CVD was defined as circulatory diseases that affect the heart and blood vessels, according to the International Classification of Diseases (ICD, 9th revision), the operational ICD at the commencement of the study. They included heart failure, hypertensive diseases (HDx) (severely elevated blood pressure and hypertensive encephalopathy), stroke and acute coronary syndrome (ACS). Minor ones were valvular heart disease, pericardial disease, rheumatic diseases and venous thromboembolism. These were grouped together as ‘others’.

Statistical analysis

Retrieved data were recorded on pre-designed Microsoft Excel spread sheets and analysed using SPSS statistical software version 23.0. Continuous variables are expressed either as mean ± standard deviation (SD) or median and interquartile range (IQR), as appropriate, and categorical data as frequencies and percentages. The independent Student’s t-test and ANOVA were used to compare means while the Mann–Whitney and Kruskal–Wallis tests were used to compare median values. Median survival according to CVD type was compared using the Kaplan–Meier curve and log rank test, respectively.

CVD admission rate was derived as a ratio of total CVD admissions to total medical admissions, CVD death rate as the ratio of total CVD deaths to total medical deaths, and CVD case fatality as a ratio of CVD deaths to CVD admissions. For ease of description, the temporal trend in admissions and deaths during the study period was partitioned quadrennially: January 2002 to December 2005, January 2006 to December 2009, January 2010 to December 2013, and January 2014 to December 2017. A p-value < 0.05 was regarded as significant at the 95% confidence interval.

Results

A total of 21 369 medical admissions were recorded during the period under review and 4 456 (20.8%) were CVD admissions. Males were slightly more predominant at 2 292 (51.4%). The median age of the CVD patients was 56.6 years (IQR 46.0–68.0). The mean age of male and female CVD patients was comparable (56.7 ± 14.3 vs 56.1 ± 15.9 years, p = 0.17). The majority of the patients [2 921 (65.6%)] were within the ages of 40 and 70 years (Table 1).

There was a total of 3 582 (16.8%) recorded medical deaths and 1 090 (30.4%) were due to CVD. The majority of the CVD

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Fig. 1. Most frequent CVD sub-types. HDx, hypertensive diseases; ACS, acute coronary syndrome.
admissions [3,288 (73.8%)] were duly discharged home following clinical improvement while 58 (1.3%) were discharged against medical advice (DAMA). The remaining 1,090 (24.6%) were mortality outcomes (CVD case fatalities). The median length of stay of the CVD admissions was 11 days (IQR 5–21 days: range 1–159 days).

Fig. 1 shows the four commonest CVD admission sub-types. Strokes (ischaemic and haemorrhagic) accounted for 2,276 (51.1%) of the total CVD admissions and 10.6% of all medical admissions during this period. Heart failure contributed 1,606 (36.0%) and 7.5% of all CVD and medical admissions, respectively, during this period.

There was a cumulative increase in the number of CVD admissions and deaths ($p_{\text{trend}} < 0.001$, respectively) every four years over the period under review (Fig. 2, Table 2). The quadrennial cumulative CVD admissions between 2002 and 2005 were 468. This rose to 1,490 at the end of 2009, representing a 201.1% increase, and it further rose to 2,883 at the end the of 2013, representing a 516.0% increase. By the end of 2017, total CVD admissions stood at 4,436, representing an 847.9% increase (Table 2).

CVD deaths followed a similar quadrennial pattern. Cumulative CVD deaths between 2002 and 2005 were 116. This rose to 1,490 at the end of 2009, representing an increase of 109.5%. It rose further to 2,883 at the end of 2013, an increase of 474.1%. By the end of 2017, total CVD deaths stood at 1,634, representing an increase of 836.6%. Although the absolute number of CVD deaths increased exponentially over the study period, increase in CVD case-fatality rates was rather subtle from 22.0 to 25.9%, with an average of 24.5% for the study period (Table 2). The temporal trends in admissions and deaths were similar in males and females (Fig. 3). However, with regard to the case-fatality ratios, there was an increasing trend in males and a decreasing trend in females (Table 2).
Stroke, heart failure, HDx and ACS constituted 51.2, 36.2, 11.3 and 1.6% of all CVD admissions, respectively. Stroke patients were predominantly male, older, had the shortest length of hospital stay and had the highest mortality rate compared to the other CVD cases (Table 3). Heart failure patients were predominantly female and had the longest length of hospital stay. However HDx and ACS had the best outcomes, with an average of 90% discharge rate (Table 3).

There was a total of 2,276 stroke admissions, constituting 51.2% of all CVD admissions. The mean age of stroke patients was 59.3 ± 13.6 years, with 1,188 (52.2%) of them being between the ages of 30 and 60 years. There was a male preponderance of 1,194 (52.4%). The mean ages of male and female stroke patients were comparable (58.9 ± 13.1 vs 59.7 ± 13.9 years, respectively, \( p = 0.16 \)). Ischaemic stroke constituted 86.3% of all stroke admissions. There was no gender difference in ischaemic and haemorrhagic stroke sub-types (\( p = 0.75 \)). Outcomes (discharge and deaths) were different for the two sub-types. The mortality rates for both ischaemic and haemorrhagic sub-types were 34.1 and 45.8%, respectively (\( p < 0.0001 \)). The median length of hospital stay for the sub-types were 11 and seven days, respectively (\( p = 0.16 \)).

Stroke admissions increased steadily during the period under review. There were 261 stroke admissions between 2002 and 2005. This rose to 735 by the end of 2009, accounting for an increase of 181.6%. Cumulative stroke admissions rose to 1,373 by the end of 2017.

Deaths from stroke followed this same trend (Table 5, Fig. 4). Death from strokes stood at 92 by the end of 2005. It rose to 175 by the end of 2009, accounting for a 90.2% increase. Cumulative stroke death was 489 (a 431.5% increase) by the 2013 and 812 (a 782.6% increase) by the end of 2017.

Heart failure constituted 1,606 (36.2%) of all CVD admissions, with a population mean age of 53.1 ± 16.6 years, and 875 (54.4%) of them were between the ages of 30 and 60 years. Females were more predominant at 844 (52.6%) and younger (54.7 ± 15.0 years, respectively, \( p < 0.001 \)). The three major causes of heart failure were HDx, dilated cardiomyopathy (DCM) and peripartal cardiomyopathy (PPCM) (Table 6).
The mortality rate from heart failure admissions was 14.0%, with HDx contributing most (45.5%) (Table 6). The median length of stay for heart failure admissions was 13.0 days (IQR 7.0–22.0 days). Length of stay was comparable in both genders (p = 0.38) and between the sub-types of heart failure aetiologies (p = 0.87). Quadrennial cumulative heart failure admission rates rose from 95 at the end of 2005 to 411 by the end of 2009, representing a 332.6% increase. It rose further to 946 (895.8%) by the end of 2013, and to 1,606 (a 1,590.5% increase) by the end of 2017 (Table 5, Fig. 4). Quadrennial cumulative heart failure death rates stood at eight by the end of 2005; 57 (a 612.5% increase) by the end of 2009; 135 (a 1,578.5% increase) by the end of 2013 and 224 (a 2,700% increase) by the end of 2017 (Table 4, Fig. 4).

HDx constituted 502 (11.3%) of all CVD admissions, with comparable male and female mean ages (53.55 ± 14.7 and 54.98 ± 16.8 years, p = 0.32) (Table 3). Males were in the majority (59%). About 55.2% of them were between the ages of 30 and 60 years. The mortality rate was similar in both genders; 10.5 and 8.7% for males and females, respectively (p = 0.13). The median length of hospital stay was comparable in both genders, namely 11.0 (5.0–17.0) days and 12.0 (7.0–19.0) days for males and females, respectively (p = 0.07). Cumulative HDx admissions rose from 127 by the end of 2005 to 268 (a 111.0% increase) by the end of 2009; 413 (a 225.2% increase) by the end of 2013, and 502 (a 295.3% increase) by the end of 2017 (Table 5, Fig. 4). Cumulative quadrennial deaths from HDx were 18 by the end of 2005; 35 (a 94.4% increase) by the end of 2009; 40 (a 122.2% increase) by the end of 2013 and 49 (a 172.2% increase) by the end of 2017.

There were 72 (1.6%) admitted cases of ACS during the period under review, with a mean age of 54.7 ± 12.9 years and a predominance of 42 (58.3%) males (Table 3). Females were relatively older (57.6 ± 11.4 vs 52.8 ± 11.6 years, p = 0.12). The majority (62.5%) of the patients were between the ages of 30 and 60 years. The median length of hospital stay was 12 (7.0–16.0) days (Table 3) and was comparable in males and females, namely 12.7 (7.1–19.3) vs 12.2 (8.2–18.3) days, respectively (p = 0.76). The mortality rate was comparable in males and females [three (42.9%) vs four (57.1%), respectively (p = 0.40)]. ACS admissions rose from five by the end of 2005 to 15 (200% increase) by the end of 2009; 45 (800% increase) by the end of 2013; and 72 (1,340% increase) by the end of 2017 (Table 5, Fig. 4). There were no deaths between 2002 and 2005; two deaths by the end of 2009; and four and three deaths by the end of 2013 and 2017, respectively (Table 5).

The seven-day mortality rate for stroke and heart failure was 66.7 and 34.8%, respectively, while for HDx and ACS it was 16.4 and 14.1%, respectively. Fig. 5 shows the Kaplan–Meier curves for the CVD cases. Stroke had the lowest survival rate and shortest length of hospital stay among the four major CVD admission sub-types, followed by heart failure. This trend persisted even after censorship of the data. ACS had the best survival estimate, although in absolute numbers it had the lowest admission rates.

**Discussion**

This research, to the best of our knowledge, is the largest hospital-based study in sub-Saharan Africa (SSA) that has studied the trends in CVD admissions and deaths. CVD cases are said to constitute about seven to 10% of all adult medical admissions in SSA.14,15 Our study found a CVD admission rate of 20.8% over a 16-year period. In Nigeria, CVD admission rates vary between 15 and 43.7%,16,22-24
A recent 10-year review of medical admissions in Ghana reported a 4.7% CVD admission frequency, with stroke admissions excluded as an outcome of interest. If stroke admissions are excised from our data, CVD admission rate would be 11.4%, which is still higher than the 4.7% from the Ghanaian study but comparable to the SSA range. Our study duration of 16 years possibly accounts for this difference. Our study also demonstrated an exponential quadrilinear increase in admission and death rates, reflecting the increasing burden of CVD and its risk factors in the general population.

We found a CVD death rate of 30.4% with a case-fatality rate of 24.6%. Similar studies in Nigeria have reported CVD death rates ranging from 16 to 34%. This wide variation could be methodological as most of the studies reporting higher death rates had older subjects, with a mean age above 65 years. Our death rate aligns with the global data that CVD deaths account for about one-third of global deaths. Our study also demonstrated that the CVD case-fatality ratio was higher in males.

The median age of our study population was 56.6 (46.0–68.0) years, comparable to findings from other studies. The median age of less than 60 years from our study population further buttresses the point that CVD events occur earlier in LMICs compared to HICs, where they occur more in individuals above the age of 60 years. This has been attributed to a mix of a huge burden of poorly controlled CVD risk factors, health inequalities and weak health systems.

The gender distribution of CVD-related admissions from our study was similar, although for heart failure admissions, females were predominant and were also relatively younger. Similar studies have documented female preponderance in their cohorts. The contribution of peripartum cardiomyopathy, an all-female disease, in the aetiology of heart failure, might be responsible for this female predominance.

Stroke was the commonest cause of admission, constituting 51.2% of all CVD admissions, followed by heart failure and HDx. Reported stroke admission rates as a sub-set of CVD admissions in the published literature ranged from 24.3 to 54.6%. A few other studies have reported heart failure as the commonest cause of admission. Heart failure admissions in our study constituted 36.2% of all CVD admissions. In Nigeria, heart failure admission rates ranged from 17.4 to 43.3%. In Ghana heart failure admissions are quite rife, accounting for about 80% of all CVD admissions. In these Ghanaian studies strokes were not included as outcomes of interest. If stroke is excised from our data, the heart failure admission rate would be 73.7%, comparable to rates from Ghana.

Over the decades, the prevalence of heart failure in Africa has risen from less than 10% to the high values reported in some of the studies cited above. This increase is not unconnected with the rising prevalence of both behavioural (smoking, unhealthy diets, physical inactivity and psychosocial stress) and biological (hypertension, dyslipidaemia, obesity and diabetes) risk factors for CVD, occasioned by the consequences of epidemiological transition and westernisation of lifestyles. In addition, these risk factors are poorly controlled due to health inequalities and fragile health systems.

The high burden of stroke from our study aligns with the established fact that SSA has the highest population-attributable risk of 90.8% (95% CI: 87.9–93.7) for stroke in SSA, higher than what was reported in the INTERSTROKE study. In Nigeria, hypertension accounts for about 80% of all cases of stroke.

Our earlier study on ER deaths also reiterated the burden of stroke and its mortality burden in hypertensive patients. In the general population, the burden of hypertension in Nigeria is mirrored by its high prevalence, low awareness, low level of optimal control and high level of poor adherence to medications for control. These interrelated factors invariably drive stroke/ CVD risk and burden. In addition, hypertension frequently co-occurs with other CVD risk factors such as dyslipidaemia, abnormal blood glucose profile/diabetes and obesity. The relative individual contributions of these risk factors and in synergy increase stroke risk and other CVD sub-types. They also hinder effective control of hypertension.

Similarly, hypertension is the commonest cause of heart failure in Africa. In the Sub-Saharan Africa Survey of Heart-Failure (THESUS-HF) study, a nine-African nation study, and the International Congestive Heart Failure study (INTER-CHF), hypertension was responsible for 45.5 and 35% of all heart failure admissions, respectively. However, in the Democratic Republic of Congo and Rwanda, DCM rather than hypertension was the most prevalent heart failure aetiology.

A recent meta-analysis on the aetiology of heart failure in SSA reported that 39.2% of cases of heart failure in Africa were caused by hypertension. Nigeria shares a similar fate. Hypertension accounts for between 56.3 and 78.5% of cases of heart failure. In our study it accounted for 49.1% of all heart failure admissions. DCM was another frequent cause of heart failure after hypertension, accounting for 37.0% of all heart failure admissions. In other parts of SSA, DCM is the most prevalent aetiology of heart failure admissions, accounting for 41.0% of all DCM admissions. However, our figure is higher than the 18.8% reported by the INTER-CHF study and the 12.0% reported by the INTER-CHF and the 12.0% reported by the INTER-CHF study that included Africans.

The higher prevalence of DCM from our study might be methodological. Our cohort might have included previously unknown hypertensives presenting in heart failure with normal or low blood pressure but with a DCM phenotype on echocardiography. This is possible because hypertension can lead to DCM, PPCM, a type of DCM, accounted for 4.1% of all cases of heart failure and 10% of all DCM causes of heart failure, respectively, in our study, comparable with the 7.7% from the THESUS-HF study and the 5.3% from the Abuja Heart Failure study.

With regard to mortality, we found a CVD mortality rate of 30.4% over the period under review. CVD mortality rates in published local data range from 10.3 to 33%. In SSA, the CVD death rate was 38.3% in 2013 and stroke was the greatest contributor. A recent 10-year review of CVD admissions (predominantly heart failure) in Ghana reported a death rate of 23.1%. In our study, stroke was the greatest contributor to mortality with a mortality rate of 35.7%. In Nigeria, death rates from stroke in CVD admission studies ranged from 10.3% to 33%. Higher mortality rates have been reported in standalone stroke registries.

Across SSA, stroke admissions and mortality rates have been on the increase in the past three decades, largely due to...
an ageing population experiencing epidemiological transition and its attendant plethora of CVD risk factors, especially hypertension. Stroke also had the shortest length of hospital stay 10 days and the highest seven-day mortality rate of 66.7% in our study. This high rate of early mortality may be due to late presentation of stroke cases at the hospital and the absence of a dedicated acute stroke unit at the time of this study. Stroke is the second most common cause of global deaths and has the highest prevalence, incidence and case fatality in SSA. Hypertension remains its pre-eminent modifiable risk factor, as discussed above. Optimal control of hypertension would significantly reduce the burden in SSA.

We found a heart failure mortality rate of 14.0% during the period under review, with 34.8% of these deaths occurring within the first seven days of admission. Heart failure death rates in Nigeria ranged between 8.1 and 13.1%. In the THESUS-HF study, the heart failure mortality rate was 4.2%. In the USA, stroke and heart failure accounted for 16.8 and 9.4%, respectively, of all CVD deaths in 2017. These are much lower than the rates in Nigeria and corroborate the globally held view that CVD rates are on the decline in the HICs but on the increase in LMICs. Socio-epidemiological factors such as ignorance, healthcare inequalities, poverty, higher prevalence of risk factors, poor access to healthcare, in addition to the huge simultaneous burden of infectious and poverty-related morbidities account for the disparate CVD death rates between Nigeria/LMICs and the HICs.

HDx and ACS were minor contributors to both admissions and deaths during the period under review. Globally, SSA still has the lowest rate of coronary heart disease. From our study, ACS was not a common contributor to CVD admissions in Nigeria, accounting for 1.6% of overall CVD admissions. Several studies in Nigeria have reported ACS admission rates ranging from 0.2 to 1.6%. Falase et al. reported a prevalence of 2.8% of angiographically confirmed coronary heart disease in Lagos. In SSA, ACS rates are reported to be between 0.8 and 10.8%. Despite the low rate, our study showed a galloping rise in cases of ACS, with a peak increase of 900% in 2012, which remained sustained until 2015, suggesting that indeed the burden of ACS is on the increase.

This rising burden may be causally related to the huge prevalence of CVD risk factors in Nigeria. It is also believed that inadequate diagnostic and treatment resources, in addition to inadequate expert manpower, may account for the lower rates of reported cases of ACS in Nigeria. With an improvement in knowledge and awareness of ACS among general practitioners, prompt referral to coronary care units, and availability and accessibility of diagnostic resources, reported cases of ACS might become more prevalent in future.

Strengths and limitations

The strength of this study lies in the 16 years it covered. To the best of our knowledge, it was able to demonstrate the burden and temporal trends of CVD admissions more so than any similar study in SSA has done.

Our study however has some limitations. First it is a hospital-based study and may not reflect the true burden of the disease. From an epidemiological point of view, population-based studies are the gold standard for understanding the burden of diseases and their determinants. In Nigeria and in most SSA, these studies are sparse due to problems of logistics, lack of reliable databases and registries and the high cost of implementing them. However, hospital-based studies are easier to carry out and therefore more common and provide indirect evidence of the burden of a disease in the general population in the absence of a population-based study. Second, the data for the study were extracted from manually stored hospital records, which sometimes are fraught with clerical errors (missing/incomplete/improperly recorded data) in the absence of electronic medical records. This may have affected our results.

Conclusion

Our study was able to demonstrate a rising trend of CVD admissions and deaths over a 16-year period. Stroke and heart failure were the major contributors to admissions and deaths, while temporal trends showed that ACS had the highest exponential rate of increase. Although this was a hospital-based study, it is a mirror of the CVD pattern in the general population. Hypertension remains the most important driver of CVD in Nigeria and frequently aggregates other sanctionable risk factors such as obesity, diabetes, dyslipidaemia and physical inactivity. With rising prevalence of these risk factors, inequities in healthcare access and an ageing population exposed to unhealthy westernised lifestyle, the burden of CVD will continue to be high in the years ahead. Strategies with large ‘effect sizes’ aimed at prevention and control of these risk factors would significantly stem the tide of CVD in Nigeria and indeed SSA.

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