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# Leisure time physical activity participation in women (30-65 years) with high coronary heart disease risk indicators

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## Abstract

The aim of this study was to determine the effect of leisure time physical activity participation (LTPA) on South African women presenting with some enhanced coronary heart disease (CHD) risk indicators (physical inactivity, hypertension, hypercholesterolemia, obesity and smoking). The respondents comprised 3 542 women, aged between 30 and 65 years ( $\bar{X} = 41.6 \pm 12.8$ years) suffering from one or more of the primary risk factors for CHD. The cut-off points for the primary CHD risk factors considered were the following: systolic blood pressure $\geq$140 mmHg, diastolic blood pressure $\geq$90 mmHg, total cholesterol > 5.2 mmol.L$^{-1}$, obesity (BMI $\geq$30) and cigarette smoking. The following physical activity categories were selected viz: high physically active (> 2 000 kcal·week$^{-1}$), moderate physically active (1 000 – 2 000 kcal·week$^{-1}$) and low physically active (< 1 000 kcal·week$^{-1}$). Data were collected by means of demographic and physical activity questionnaires as well as field tests, and assessing total cholesterol, blood pressure and obesity. The respondents were selected from two age groups (30-49 and 50-65 year) representing primarily the pre- and postmenopausal phases of female life. Leisure time physical activity participation does not alter the selected primary coronary heart disease risk factors in the pre- and post-menopausal women significantly. Physically inactive women, however, tend to present more health risks than those participants in the moderately and high physical activity group. The prevalence of health risks increases with age inspite of participation in LTPA. The number of health risk indicators can be reduced by increasing LTPA, thus contributing to the management of the women's general health. Women should be encouraged to take responsibility for managing their own health by engaging in a healthy lifestyle in order to manage their health risks properly. This may require a multidisciplinary approach.

**Key words:** Women, hypertension, hypercholesterolemia, obesity, smoking, physical inactivity.

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## Introduction

Physical inactivity is labelled as one of the primary risk factors for the development of cardiovascular disease as well as other chronic diseases (ACSM, 2010). It is also well documented that physical inactivity is positively associated with other health risk indicators, viz: obesity, hypercholesterolemia and hypertension (Ehrman, Gordon, Visich & Keteyian, 2009). The higher the prevalence of health risks in an individual, the greater his/her risk for morbidity and mortality – a ratio that increases exponentially as the amount of risks increases.

According to the literature, regular participation in physical activity can promote women's health through the following avenues: increasing life expectancy, decreasing the risk of coronary heart disease, diabetes and hypertension; lowering the feeling of depression and anxiety and contributing to a better quality of life (Nieman, 1998; Roberts, Towell & Golding, 2001). Kruger, Ham and Kohl (2005) argued that the average adult woman, who adequately participates in physical activity, stays relatively stable regarding health status. From the above discussion it appears that physical activity seems to be an important component for the maintenance and improvement of health and quality of life.

Research indicated that in 1994, 30% of South African women above the age of 70 years were physically inactive (Kruger *et al.*, 2005). According to Kruger *et al.* (2005) the high prevalence of cardiovascular disease and mortality amongst South African women in 1994 reflects a strong correlation with the low prevalence of physical activity participation. This places physically inactive older women at higher risk stratification for the development of cardiovascular diseases (Kruger *et al.*, 2005). In a national South African survey including all ethnic groups, 88.8% of the women reported non-participation in any leisure time physical activity (DSR, 2005). This is similar to the findings of the study of Loock (2008) which indicated that 80.1% and 77.4% pre- and postmenopausal women (all ethnic groupings) respectively can be stratified as low physically active ($<1000$ kcal.week$^{-1}$).

Women in the high physically active group tend to present fewer health risks (Loock, 2008). They also tend to smoke less and have a lower consumption of alcohol and hormone replacement therapy (Folsom, Kushi & Hong, 2000). It also appears that physically active women are more concerned about their health which may lead to a lower incidence of tobacco and alcohol consumption (Kawachi, Troisi, Rotnitzky, Coakley & Colditz, 1996). A possible reason why physically active women tend to use less hormone replacement therapy may be because moderate physical activity may influence most of the menopausal symptoms such as hypertension and hypercholesterolemia as well as emotional mood swings (Folsom *et al.*, 2000; Karalis, Beevers, Beecers & Lip, 2005, Ehrman *et al.*, 2009).

The classic studies of Morris and Paffenbarger (Blair & LaMonte, 2007) on physical activity epidemiology indicated a "protective" value of physical activity participation, regarding mortality from cardiovascular disease as well as all-cause mortality. Evidence exists that this protection against mortality may appear even in the presence of existing risk factors (Barlow, Brill, Blair & Kohl, 1990). According to Musich, McDonald, Hirschland and Edington (2003), it is of paramount importance to manage the health risks in a population effectively as individuals may migrate by 2-4% to a higher risk category annually, if left unattended to. Increased numbers of health risks are also associated with increased health care costs, and when productivity measures are factored in, the costs may even be doubled or tripled (Musich *et al.*, 2003). Therefore, from a monetary point of view, companies such as national health insurer should identify high risk members and intervene with proper health risk management. In this regard Loock (2008) reported a significant prevalence of primary CHD risk factors in female members of a national health insurance company. Another factor that may complicate this situation further is that the South African female population consists of diverse ethnic groups, each presenting some unique profiles of health risks (Strydom, 2005).

Little information could be found regarding the influence of leisure time physical activity participation on South African women who had already developed enhanced coronary risk indicators. The aim of this study, therefore, was to investigate the impact of leisure time physical activity participation on South African women (30–65 year) who had suffered from at least one of the primary CHD risk factors i.e.: hypertension, hypercholesterolemia, obesity and smoking (ACSM, 2010). Knowledge regarding this may lead to the implementation of effective intervention programmes – not only enhancing the quality of life but also decreasing morbidity and mortality (Ehrman *et al*., 2009).

## Materials and Methods

### Study design

This was a cross-sectional descriptive survey of an available population, being members of a comprehensive national health insurance company in South Africa. As part of their health promotion initiative the insurer offers wellness days where some health risk analysis was done on members who volunteered to this endeavour.

### Participants

Overall the data of 3542 women aged 30-65 years ($\bar{x}$ =41.6±12.8) of which 2831 were premenopausal (30-49 years) and 711 postmenopausal (50-65) were captured. Only data of subjects who were stratified in the high risk category regarding the following parameters: physical inactivity, systolic blood pressure, diastolic blood pressure, total cholesterol, body mass index (BMI) and smoking were analysed. Therefore, the number of subjects who participated in this study varied from 550 – 3038 (Table 1). Ethnic classification was not done, because ethnicity is not a factor in any of the intervention strategies initiated by the national health insurer.

The cut off point of age for pre- and postmenopausal women was based on literature indicating that it normally takes place between the ages of 48 and 52 years (Beake, Zimbizi & Stevens, 1996).

**Data collection procedure**

The following data were gathered from all participants:

Demographic information

Demographic information was collected by using a questionnaire which revealed personal details on each participant.

Physical activity index (kcal.week$^{-1}$)

Physical activity participation was determined by analysing the frequency, intensity and duration of leisure time participation. This information was then calculated and expressed as an index (kcal.week$^{-1}$). According to the calculations, the respondents were classified as low active (< 1 000 kcal·week$^{-1}$), moderate active (1 000 – 1 999 kcal·week$^{-1}$) and high active ($\geq$ 2 000 kcal·week$^{-1}$) (ACSM, 2010).

Blood pressure

The blood pressure measurements were taken as suggested by the American College of Sports Medicine (ACSM) (ACSM, 2010). For the purpose of this study, only subjects displaying high risk values were included. A resting systolic blood pressure of $\geq$140 mmHg and/or a resting diastolic blood pressure value of $\geq$90 mmHg were used as cut-off points (ACSM, 2010).

Total cholesterol concentration (mmol·L$^{-1}$)

The total cholesterol concentration was determined by analysing arterial blood obtained from a finger prick as suggested by the ACSM (ACSM, 2010). The cut-off value for the high risk group was set at a total cholesterol value of $\geq$ 5.2 mmol·L$^{-1}$ (ACSM, 2010). The Accutrend was used for this assessment and was calibrated before each operation according to the prescription of the manufacturer. Because of the logistical challenges in this project a non-fasting blood specimen was collected. According to Vermaak (1991), a non-fasting value is acceptable in order to stratify respondents into a risk classification.

Stature, body mass and body mass index (BMI)

For the determination of stature, the respondents stood against a wall barefoot with heels, buttocks and shoulders touching the wall. The head was positioned in the Frankfort plane and height measured to the nearest 0.5 cm (ACSM, 2010). Body mass was determined on a scale which was calibrated regularly. Only light exercise clothing was permitted and the weight was noted to the nearest 0.5 kg. The BMI was determined by using the formula body mass divideved by stature in metres squared ($kg{\cdot}m^{-2}$) where kg represents the body mass in kilogram (kg) and m the body height in metre which is then squared (ACSM, 2010). For the purpose of this study, the cut-off point for obesity was set at a BMI $\geq$ 30 (Ehrman *et al*., 2009).

Smoking

Respondents were asked whether they smoke or not. Smoking is classified as a risk regardless of the number of cigarettes smoked per day. Therefore, all participants who used to smoke were included in this study (ACSM, 2010).

**Statistical Analysis**

The STATISTICA software programme for Windows (StatSoft, Inc., 2006) was used for the statistical analysis. Descriptive statistics were used to determine risk profiles of the respondents.

Two-way frequency tables were used to determine if there were any associations between the physical activity participation and the risk factors. The phi coefficient was used as a measure of the strength of the association, with phi = 0.1 indicating a small association, while phi = 0.3 and phi=0.5 showing moderate and large associations, respectively.

**Results**

In Table 1 the data of pre- and post-menopausal women stratified in the high risk category regarding the primary CHD risk factors are presented. For the pre-menopausal women the ranking order of the prevalence of the risks was as follows: physical inactivity (86.6%), obesity (38.9%), hypercholesterolemia (31.4%), diastolic hypertension (19.4%), smoking (15.4%) and systolic hypertension (14.2%). For the post-menopausal women the ranking order of the prevalence of the risks for the younger age group was as follows: physical inactivity (82.3%), hypercholesterolemia (53.7%) and obesity (38.1%).

**Table 1:** The descriptive data of the pre- and post-menopausal women with elevated primary coronary heart disease risk factors

| | Pre-menopausal (30 – 49 year) N = 2831 | | | | | Post-menopausal (50 – 65 year) N = 711 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable | *n(%)* | $\bar{X}$ | *SD* | *Min* | *Max* | *n(%)* | $\bar{X}$ | *SD* | *Min* | *Max* |
| PA (< 1 000 kcal·week⁻¹) | 2453 (86.6) | 181.6 | 269.8 | 0 | 990 | 585 (82.3) | 203.3 | 280.3 | 0 | 990 |
| SBP ($\geq$ 140 mmHg) | 401 (14.2) | 148.1 | 10.3 | 140 | 197 | 223 (31.4) | 151.4 | 13.3 | 140 | 208 |
| DBP ($\geq$ 90 mmHg) | 548 (19.4) | 95.1 | 7.2 | 90 | 140 | 215 (30.2) | 95.8 | 7.4 | 90 | 140 |
| Cholesterol ($\geq$ 5.2 $mmol.L^{-1}$) | 888 (31.4) | 6.00 | 1.2 | 5.2 | 20 | 382 (53.7) | 6.1 | 0.7 | 5.2 | 9 |
| Body mass index ($\geq$ 30 $kg.m^{-2}$) | 1100 (38.9) | 34.5 | 6.4 | 30 | 58.8 | 271 (38.1) | 35 | 5.6 | 30 | 65.9 |
| Smoking ($\geq$ 1 $cigarettes.day^{-1}$) | 437 (15.4) | 11.2 | 7.0 | 1 | 40 | 113 (15.9 ) | 15.0 | 7.1 | 3 | 40 |

PA = Physical activity; SBP = Systolic blood pressure; DBP = Diastolic blood pressure

In Tables 2 and 3 the prevalence of primary coronary heart disease risk factors for pre- and post menopausal women at different levels of physical activity are presented. The "at-risk" sample also tends to be more physically inactive. In the pre-menopausal group (Table 2) between 79% - 81.2% of the participants with the various risk factors can be classified as low physically active, while between 9.4% - 12.5% and 6.8% - 10.2%, respectively can be stratified as moderate and high active. In the post-menopausal group basically the same tendency existed (Table 3).

**Table 2:** Leisure time physical activity and prevalence of high risk factors amongst pre-menopausal women

| | Pre-menopausal (30 – 49 year) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low Active (< 1000 $kcal/week^{-1}$) | | | Moderate Active (1000 – 1999 $kcal/week^{-1}$) | | | High Active ($\geq$ 2000 $kcal/week^{-1}$) | | | |
| Variable | n | *n* | % | $\bar{X}$ | *n* | % | $\bar{X}$ | *n* | % | $\bar{X}$ | p-value |
| SBP ($\geq$ 140 mmHg) | 382 | 307 | 80.4 | 148.1 (SD=10.5) | 36 | 9.4 | 149.0 (SD=11.3) | 39 | 10.2 | 147.0 (SD=8.7) | 0.709 |
| DBP ($\geq$ 90 mmHg) | 518 | 409 | 79 | 95.2 (SD=7.5) | 61 | 11.8 | 94.5 (SD=5.2) | 48 | 9.3 | 94.7 (SD=6.5) | 0.745 |
| Cholesterol ($\geq$ 5.2 $mmol.L^{-1}$) | 859 | 690 | 80.3 | 6 (SD=1.2) | 107 | 12.5 | 5.9 (SD=0.6) | 62 | 7.2 | 6.1 (SD=1.9) | 0.443 |
| Body mass index ($\geq$ 30 $kg.m^{-2}$) | 1090 | 877 | 80.5 | 34.4 (SD=6.7) | 113 | 10.4 | 34.4 (SD=5.6) | 100 | 9.1 | 35.6 (SD=6) | 0.185 |
| Smoking ($\geq$1 $cigarettes/day^{-1}$) | 426 | 346 | 81.2 | 11.4 (SD=7.2) | 51 | 12.0 | 10.2 (SD=6.2) | 29 | 6.8 | 11.7 (SD=7.3) | 0.489 |

SBP = Systolic blood pressure; DBP = Diastolic blood pressure

When the mean value of the risk factors at the various activity levels was compared, no statistical significant differences ($p \geq 0.05$) occurred in either the pre- or post-menopausal group. For instance the pre-menopausal women in the low physically active group had a systolic pressure of 148.1 mmHg, compared to the 149mmHg and 147mmHg for the moderate and high active respondents, respectively. As far as the pre-menopausal group (Table 2) is concerned, a slight decrease in the mean value of systolic and diastolic blood pressure occurred when the low active group was compared to the high active group. All other risk factors (hypercholesterolemia, obesity and smoking) indicated a slight increase in the high activity group. However no statistically significant difference occurred in any of the activity levels.

**Table 3:** Leisure time physical activity and prevalence of high risk factors amongst post-menopausal women

| | Post-menopausal (50-65 year) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low Active (< 1000 kcal/week⁻¹) | | | Moderate Active (1000 – 1999 kcal/week⁻¹) | | | High Active (≥ 2000 kcal/week⁻¹) | | | |
| Variable | n | n | % | $\bar{x}$ | n | % | $\bar{x}$ | n | % | $\bar{x}$ | p-value |
| SBP (≥ 140 mmHg) | 213 | 174 | 81.7 | 151.6 (SD=13.9) | 22 | 10.3 | 152.4 (SD=11.0) | 17 | 8 | 149 (SD=10.9) | 0.723 |
| DBP (≥ 90 mmHg) | 205 | 168 | 82 | 95.7 (SD=7.3) | 19 | 9.3 | 95 (SD=6.5) | 18 | 8.8 | 97.3 (SD=9.6) | 0.625 |
| Cholesterol (≥ 5.2 mmol.L$^{-1}$) | 365 | 285 | 78.1 | 6.1 (SD=0.7) | 41 | 11.2 | 5.9 (SD=0.6) | 39 | 10.7 | 6.1 (SD=0.6) | 0.303 |
| BMI(≥ 30 kg.m$^{-2}$) | 265 | 216 | 81.5 | 34.7 (SD=5.6) | 25 | 9.4 | 36.8 (SD=5.1) | 24 | 9.1 | 35.7 (SD=6.1) | 0.168 |
| Smoking (≥ 1 cigarettes.day$^{1}$) | 111 | 94 | 84.1 | 15.1 (SD=7.2) | 7 | 6.3 | 9.6 (SD=5.1) | 10 | 9.0 | 17.5 (SD=6.6) | 0.071 |

SBP = Systolic blood pressure; DBP = Diastolic blood pressure

Regarding the post-menopausal group a slight decrease also occurred in the systolic blood pressure in the high active group, while all other parameters showed a slight increase in the mean value of the various parameters – except for cholesterol which remained at the same level of 6.1 mmol.L$^{-1}$. As in Table 2, no statistical significant differences occurred between the mean values of the risk factors for this group as well (Table 3).

**Table 4:** Risk category stratification of pre- and post-menopausal women presenting enhanced CHD risk factors at different levels of physical activity

| | Premenopausal (N = 3062) | | | | | | Postmenopausal (N= 756) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Physical Activity level | Low Active (N =2453) | | Moderate Active (N = 355) | | High Active (N = 254) | | Low Active (N = 585) | | Moderate Active (N = 89) | | High Active (N = 82) | |
| | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* | *n* | *%* |
| Low | 846 | 34.5 | 266 | 74.9 | 175 | 68.6 | 109 | 18.6 | 59 | 66.3 | 52 | 63.4 |
| Medium | 1347 | 54.9 | 81 | 22.8 | 77 | 30.2 | 340 | 58.1 | 27 | 30.3 | 26 | 31.7 |
| High | 260 | 10.6 | 8 | 2.3 | 3 | 1.2 | 136 | 23.3 | 3 | 3.4 | 4 | 4.9 |

The participants were categorised into various activity groups (low, moderate and high) as well as in low, medium and high risk stratification (Table 4). For the purpose of this study, participants showing no more than one of the primary risk factors were classified as low risk participants, while those having 2-3 and 4-5 of the risk factors were classified as medium and high risk participants, respectively. Statistical significant associations ($p<0.001$) in both pre- and post-menopausal groups indicate that the highest prevalence of low active participants fall into the medium risk category, while in the moderate and high active group, most of participants fall under the low risk group (74.9% & 68.6% respectively). The same trend occurs in the post-menopausal group with 66.3% and 63.4% of the moderate and high active respondents falling under the low risk stratum. The phi-coefficients of 0.31 and 0.43 for the pre- and post-menopausal groups indicated that in both groups the low active participants are in practice more likely to be categorised into the medium to high risk groups as is the case with the moderate and high active respondents.

**Discussion**

The participants in this study were all suffering from at least one or more of the primary CHD risk factors which placed them at in a high risk for the development of CHD (LaMonte, 2008).

Research literature indicates that during pre-menopausal phase women suffer less from CHD risks than their male counterparts past this life stage (Dosy, Masse, Cole, Evroski, Allaer & Dastoas, 2004; Rosano, Vitale, Marazzi & Volterrani, 2007) which can be partly explained by the protective role played by the ovarian hormones (Vander, Sherman & Luciano, 2001). Results of the analysis of prevalence of the primary CHD risk factors in this high risk population (pre- and post-menopausal) group are of major concern, suggesting a higher health care cost, both for the individual and company (Smit, 2008), as well as the possibility of premature morbidity and mortality (LaMonte, 2008).

The salutogenic effect of physical activity on cardiovascular health is well documented (Ehrman *et al.*, 2009). However, when the mean values of the various risk factors between the different leisure time physical activity levels were compared, no statistical significance existed among the groups. This seems to be in contrast to the published literature, which reported an improvement in the various risk factors due to physical activity intervention (Smit, 2008; Ehrman *et al.*, 2009). It must, however, be kept in mind that the participants in this study were all already stratified as a 'high risk' sample, suffering from least one or more of the primary CHD risk factors. In this regard the literature indicates that the commonly held notion that exercise is beneficial for general improvement of health is not always so simple. For instance one hypothesis in individuals presenting with an abnormal lipid profile is that they may have intractable lipid profiles which do not favourably respond to exercise training as normally expected (Biggerstaff & Wooten, 2009). This may be related to a specific apo-E genotype in individuals causing inadequate hydrolysis of triglycerides (Biggerstaff & Wooten, 2009).

As far as hypertension and obesity are concerned, literature also indicates a salutogenic effect for patients following a physical activity intervention programme. It is, however, important to note that these exercise interventions are scientifically based, addressing the required intensity, frequency and duration of the exercise programme (Contracter & Gordon, 2009; Murdy & Ehrman, 2009). This again highlights the fact that exercise therapy should be administered as medicine, and the correct type of dosage and frequency should be prescribed for a specific ailments in order to evoke the required rehabilitative response.

Another factor which may contribute to this contradiction is that only about 15% of their energy consumption is spent on leisure activities, while about 85% is spent on non-leisure activities (LaMonte, 2008). Therefore, by only taking into account the leisure time physical activity participation together with relatively small numbers in some of the groups may bias the results (LaMonte, 2008).

Although the mean value of the CHD risk factors does not change significantly within the various activity groups, research has indicated that just by embarking on a moderate physically active lifestyle, morbidity and mortality of CHD may be lowered and cardiovascular benefits may be achieved (LaMonte, 2008). It, therefore, appears that participating in regular physical activity may produce a "natural immunity" against the detrimental effects of the various risk factors (Smit, 2008).

The results of this studied also showed that participants who reported moderate to high physical activity levels are less prone to fall into the high risk category. This implies that respondents can minimize their risks by becoming more physically active. This is supported by results of various research studies (Stangl, Baumann & Stangl, 2002; Karalis *et al.*, 2005; Ehrman *et al.*, 2009). It is important to control/manage health risk factors, as research has indicated that if it is left untreated/unmanaged, 2-4% of the individuals may annually migrate to a higher risk level, resulting in increased health care cost and higher prevalence of chronic health conditions (Musich *et al.*, 2003).

The primary risk factors found in this study are mainly rooted in the individuals' lifestyle. One of the detrimental lifestyle habits is physical inactivity and by just changing from an inactive to a moderately physically active lifestyle may result in significant improvement in health. The challenge, however, posed to health and fitness professionals is to come up with innovative initiatives and research, to find ways and means to get the South African women more physically active – as the major reasons issued by South African women for not participating, are a lack of interest (28.1%). Age (19.2%), no particular reason (15.8%), time constraints (11.2%) and lack of opportunities/facilities (11.2%) were also mentioned as barriers in this regard (DSR, 2005). Thus it can be inferred that a lack of interest, age and unexplained reason are the constraints responsible for 63.1% of women not participating in physical activity, a trend that could possibly be changed by empowering the population with knowledge of how to accept responsibilities for their own health and wellness.

## Limitations

The findings of this study should be interpreted in the light of a number of limitations. Small numbers of respondents reporting some of the risk factors may limit accuracy. Another limitation is the lack of objectivity in determining the physical activity profiles, as they were determined by self-report questionnaires. The logistics of this study, however, leave no other option as to use a recognized procedure. Another limitation which may affect the results was the fact that non-leisure time physical activity was not taken into account. That implies that women who reported low LTPA but who were very active during their non-leisure time (heavy physical occupational duties) were stratified into the "low active category – while their highly active occupational duties could influence the variables measured.

## Conclusion

The results of this study suggest that the level of leisure time physical activity participation does not significantly change the condition of a primary CHD risk factor in a high risk sample of South African women. This is contradictory to research findings indicating positive changes in high CHD risks. Possible reasons for this have already been discussed. Another factor which may also influence this study is that a respondent showing a risk factor at a relatively young age (pre-menopausal) may also have some family history/genetically related prevalence of CHD risk factors that may not respond to physical activity as normally expected. However, this research should be carried out on a larger sample of high risk women, adjusting for the limitations already mentioned.

The high prevalence of primary CHD risk factors in this study, however, is of major concern and the challenge of inventing innovative intervention programmes needs to be addressed at all levels in order to manage the health risks effectively using a multidisciplinary approach.

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