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Risk and Postural Assessment: A Case Study of a Hatchery

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ABSTRACT

The hatchery environment poses several occupational hazards, ergonomic challenges, and mechanical risks, which can affect worker safety and productivity. Addressing these risks is crucial to creating a safer workplace and reducing long-term health implications for employees. This study aims to assess risks and workers' postures in a hatchery environment to provide evidence-based recommendations for improved safety practices. Hazards in the hatchery were identified through observational surveys and incident reports. The Risk assessments of the identified hazards were conducted using a Risk Rating Matrix. Workers' postures were assessed using the Rapid Entire Body Assessment (REBA) method and Ergonomic risks were identified and necessary adjustments were proposed and also. The results revealed a range of hazards that posed varying degrees of risks to workers in the hatchery environment. Key hazards included unguarded belts, water on the floor, bad equipment, and heavy egg boxes, each contributing to potential safety concerns such as slips, trips, mechanical injuries, and physical strain. The risk assessment categorized these hazards, identifying critical areas that required immediate or short-term interventions, particularly for risks associated with unguarded machinery and exposed electrical wires. The ergonomic assessment through REBA showed that 88.5% of workers' postures fell within the medium-risk category, highlighting the need for immediate corrective measures. This study highlights the importance of addressing workplace hazards and ergonomic challenges to ensure a safer environment for Hatchery Casual Workers (HCWs).

INTRODUCTION

In today's fast-paced world, the agricultural sector plays a vital role in meeting the ever-growing demands for food production. Today, with the increase in food demand due to population growth, poultry production has become an even more important sector with its favourable aspects (Yayli and Kilic, 2022). The poultry business has experienced remarkable expansion over the past two decades, facilitated by the unwavering commitment of personnel across several sectors, including farms, hatcheries, processing facilities, and feed mills. Nonetheless, these individuals are consistently subjected to occupational and environmental health risks throughout their everyday poultry processing tasks (Mohammed *et. al.,* 2018). A hatchery is responsible for gathering hatching eggs from the breeder farm and supplying freshly hatched chicks to commercial poultry farms (Kim and Kim, 2010). Hatcheries, being crucial components of the poultry industry, are instrumental in the hatching and early growth stages of poultry. Poultry birds, like all other vertebrate organisms, have a circadian rhythm that is controlled by the natural light/dark cycle of day and night (Kumar and Patyal, 2020).

The chicks are hatched in commercial hatcheries for laying hens in a presumably stressful environment, which might affect their welfare and production later in life (Hedlund, 2022). The general effect of noise on the hearing of workers has been a topic of debate among scientists for years. (Mndeme and Mkoma, 2012). Although broiler farming has a high-profit potential, farmers are often faced with various risks that can affect business sustainability and profits. Many hatchery tasks require workers to stand for extended periods, often in awkward postures. Prolonged standing can lead to fatigue, lower back pain, and circulatory issues. Williams *et al.* (2022) noted that poor posture, such as bending forward or hunching over during tasks like egg inspection or chick vaccination, exacerbates these problems. Brown *et al.* (2021) also reported that slip-and-fall accidents and machinery-related injuries are among the leading causes of workplace incidents in hatcheries. These risks can negatively impact productivity, profitability, and business sustainability (Hidayat and Oktaviannur, 2024).

Poor postures, particularly spinal twisting linked to the transportation of large objects during certain activities, can frequently accelerate musculoskeletal degeneration (Carvalho *et. al.,* 2015). Therefore, risk control is very important in hatchery business management to minimize the negative impacts that may arise. Risk control is an important component of hatchery business management, with farmers and companies working together to provide the equipment and supplies needed to maintain business continuity and maximize profits (Hidayat and Oktaviannur, 2024). Workers involved in poultry operations and communities residing nearby are constantly subjected to various hazards and safety issues (Kumar, 2020). Hatchery work often involves repetitive motions, prolonged standing, and heavy lifting, leading to musculoskeletal disorders. Johnson (2018) highlighted that tasks such as egg handling, chick sorting, and cleaning equipment can result in repetitive strain injuries and lower back pain. Poor ergonomic practices and lack of proper training further exacerbate these issues, affecting workers' long-term health and productivity.

However, occupational accidents frequently occur due to a lack of knowledge, carelessness, the nature of work itself, over-exertion and being struck by an object while falling from a height causes most of the fatalities, which accidentally affects the economic efficiency of many industries (Ajayeoba *et al.,* 2017). However, Ergonomic improvements can reduce fatigue and prevent injuries, leading to higher performance levels. Caieiro *et. al*. (2020), revealed the need to investigate more thoroughly the occurrence of musculoskeletal symptoms among poultry farming workers. Also, Johnson *et al.* (2018) emphasized that ergonomic interventions not only improve worker health but also enhance overall operational efficiency. Thus, there is a need for risk evaluation of the hatchery and postural assessment of the workers in the hatchery.

MATERIALS AND METHODS

This research was conducted in a selected hatchery at Awe, Oyo State, Nigeria, ensuring that it is representative of the typical operations within the industry. Fifty-two HCWs were considered in this research. Groups of different categories of hatchery operators and workers were randomly selected for examination. Pictures of the HCWs were taken at different postures for analysis. Questionnaires (on demographic data on age, gender and educational qualification) and oral interviews were used for data collection. Possible Hazards were identified via questionnaire and personal involvement. The Risk Rating Matrix was used to assess the identified hazards at the selected hatchery in terms of the likelihood and consequence of the hazard. The data obtained from the questionnaire in terms of likelihood and consequences were then analyzed using Figure 1 to determine the risk scores or the risk index of each body part prone to accident. The risk score or risk index of each part of the body prone to the accident was calculated as the product of the likelihood and consequence. The Risk Rating Matrix was used to analyze the identified hazards. The consequences and likelihood of all the identified risks were determined and their risk levels (Table 1) were determined.

	LIKELIHOOD				
CONSEQUENCES	Rare (1)	Unlikely (2)	Possible (3)	Very Likely (4)	Almost Certain (5)
Catastrophic (5)	Moderate **(5)**	Moderate **(10)**	High **(15)**	Critical **(20)**	Critical **(25)**
Major (4)	Low **(4)**	Moderate **(8)**	Moderate **(12)**	High **(16)**	Critical **(20)**
Moderate (3)	Low **(3)**	Moderate **(6)**	Moderate **(9)**	Moderate **(12)**	High **(15)**
Minor (2)	Very low **(2)**	Low **(4)**	Moderate **(6)**	Moderate **(8)**	Moderate **(10)**
Insignificance (1)	Very low **(1)**	Very low**(2)**	Low **(3)**	Low **(4)**	Moderate **(5)**

Figure 1: Risk Rating Matrix (Source: Ajayeoba *et al.,* 2021)

Table 1: Actions Required for the Risk Rating Matrix Results

Risk Level Rating	Required Action
Critical	Immediate action is needed. Access to the hazard should be restricted until the risk can be lowered to an acceptable level.
High	Action is needed quickly (within 1-2 days). The task should not proceed unless the risk is assessed and controlled.
Moderate	Action is required this week to eliminate or minimize the risk.
Low	Action is required within a reasonable time frame (2-4 weeks) to eliminate or minimize the risk.
Very low	Risk is to be eliminated or lowered when possible.

Source: (Ajayeoba *et al.,* 2021).

One of the requirements for evaluating job activities is postural analysis (Al-Madani and Dababneh, 2016). Thus, Rapid Entire Body Assessment (REBA) was used for the postural analysis of work-related musculoskeletal risk factors. Data were collected to analyze some basic postures (neck, trunk, leg, arm and wrist) of the machine operators and other workers regarding their activities as shown in the REBA assessment worksheet, as shown in Figure 2.

RESULTS AND DISCUSSION

Hatchery Casual Workers (HCWs) mostly do the sorting of eggs/chicks, washing of the basket, cleaning of the environment and incubator. Most of the HCWs considered fall within the 21-30 years age group, representing 61.5% of the workforce. This significant proportion suggests a youthful workforce, likely consisting of individuals in the early stages of their careers. The 31-40 years age group accounts for 11.5% of the workforce. This segment typically comprises individuals with a moderate level of experience, likely balancing career growth with personal responsibilities. The 41-50 years age group, which makes up 23.1% of the workforce, reflects a more experienced segment. The smallest representation is seen in the 51-60 years age group, which constitutes only 3.8% of the workforce. Notably, no workers are below 20 years of age. This could be attributed to labour regulations, the nature of the job requiring adult participation, or the recruitment policies of the organization.

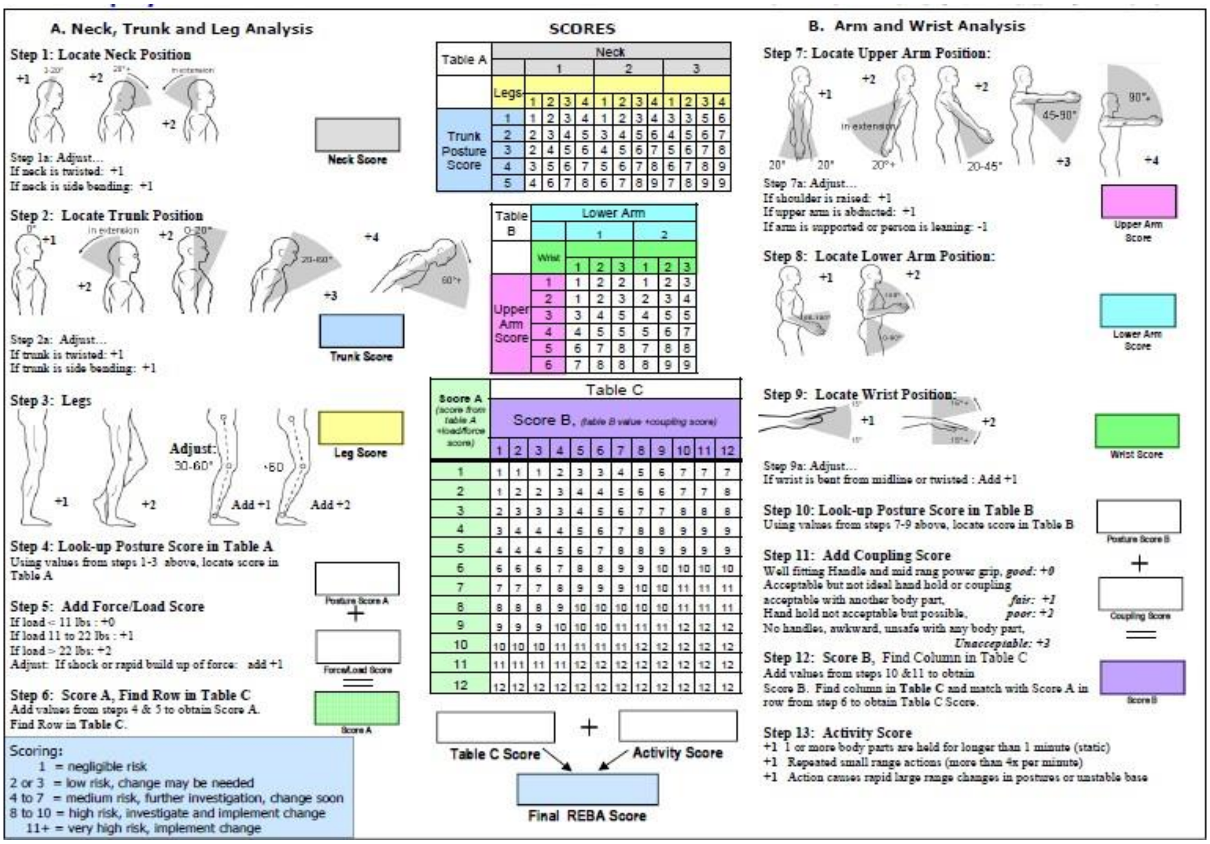

Figure 2: REBA Assessment Worksheet (Source: Ajayeoba, 2019)

The gender demographic data reveals that females make up most of the workforce, accounting for 60% of the total workers. This indicates a strong female representation within the workforce, which could reflect the nature of the job or organizational recruitment policies that encourage gender inclusivity. Males constitute 38.5% of the workforce, representing a smaller yet substantial portion of the team. While this group is outnumbered by their female counterparts (61.5%), their presence underscores a gender-diverse workforce, fostering a balanced perspective in decision-making and task execution.

The data in Table 2 indicate that 15.4% of the workforce reported having no formal education. These workers may rely more on practical experience or skills acquired outside formal schooling. The majority of the workers have attained secondary education, accounting for 53.8% of the workforce. This suggests that secondary education serves as the most common level of qualification among workers, possibly aligning with the minimum educational requirements for their roles. Workers with primary education make up 30.8% of the workforce, representing a significant portion. This group may primarily occupy roles that require basic literacy and numeracy skills. None of the workers had a tertiary education. This reflects the nature of the job, which might not demand higher educational qualifications.

Table 2: Demographics of HCWs

Variables		**Hatchery Casual Workers**	
		Frequency (n)	**Percentage (%)**
Age Range (years)	<20	0	0
	21-30	32	61.5
	31-40	6	11.5
	41-50	12	23.1
	51-60	2	3.8
Gender	Male	20	38.5
	Female	32	61.5
Education level	No formal education	8	15.4
	Primary education	16	30.8
	Secondary education	28	53.8
	Tertiary education	0	0.0
Years of Experience	1-5	32	61.5
	5-10	12	23.1
	10-15	0	0.0
	15-20	8	15.4
Daily working hours	1-2 hours	0	0.0
	2-3 hours	0	0.0
	3-4 hours	0	0.0
	4-5 hours	12	23.1
	>5 hours	40	76.9
Working Days	1-2 Days	0	0.0
	2-3 Days	0	0.0
	3-4 Days	0	0.0
	4-5 Days	12	23.1
	5-6 Days	40	76.9

Also from Table 2, most workers, 61.5%, fall within the 1 – 5 years of experience category, which indicates that a significant portion of the workforce consists of relatively new entrants into the field. Workers with 5- 10 years of experience represent 23.1% of the workforce. This group likely consists of individuals who have moved beyond the novice stage and gained intermediate-level expertise. Notably, no workers fall within the 10-15 years of experience range, creating a noticeable gap in mid-level expertise. The 15-20 years of experience category accounts for 15.4% of the workforce. These are the most experienced workers, likely possessing advanced skills, institutional knowledge, and the capacity to mentor less experienced colleagues.

The daily working hours data reveal that most workers, 76.9%, work for more than 5 hours daily. This indicates that most workers are engaged in work schedules, which may suggest a high level of commitment. On the other hand, 23.1% of the workforce works for 4-5 hours daily, representing a smaller group with relatively shorter work durations. While this group is less common, their inclusion provides flexibility and could contribute to maintaining a balanced workforce. Similarly, most workers, 76.9%, work for 5-6 days per week, indicating a standard or extended workweek for most employees. This suggests a high level of engagement and aligns with typical work schedules in industries requiring sustained productivity. A smaller portion, 23.1%, works 4-5 days per week, reflecting shorter work schedules. These workers may be those with flexible work arrangements, contributing to workforce diversity and adaptability. The predominance of longer workweeks highlights the need to manage workloads effectively to prevent fatigue. Meanwhile, the smaller group with shorter workweeks provides a degree of flexibility, ensuring balance and potential coverage during peak periods.

Musculoskeletal Disorders/Injuries (MSDs) Associated with HCWs

Table 3 presents a detailed overview of the musculoskeletal disorder/injury problems faced by the HCWs, highlighting the severity and consequences of various hazards. The body parts identified here are also similar to the work of Caieiro *et. al*. (2020). This comprehensive assessment provides valuable insights into the occupational health and safety challenges in HCWs, necessitating targeted interventions to mitigate risks and protect workers' health.

Table 3: Musculoskeletal Disorders/Injuries

MSDs	Frequency (n)	Percentage (%)
Neck	24	46.2
Upper back	24	46.2
Lower back	28	53.8
Shoulder	36	69.2
Elbow	12	23.1
Wrist/hands	20	38.5
Hips/thighs	36	69.2
Knees	28	53.8
Ankles/feet	32	61.5

i. **Neck:** Twenty-four workers (46.2%) were faced with neck pain, which is caused by awkward posture while working. Proper ergonomics will drastically reduce this effect.

ii. **Upper Back Pain:** Twenty-four workers reported upper back pain, making up 46.2% of the workforce. This issue is often associated with poor posture, repetitive tasks, or prolonged static positions while working. Upper back pain can reduce comfort and productivity if not addressed, highlighting the need for ergonomic interventions and promoting proper posture through training.

iii. **Lower Back:** Twenty-eight workers, or 53.8%, reported experiencing lower back pain. This is commonly caused by improper lifting techniques, prolonged sitting, or physically demanding tasks. Without proper ergonomics and training, lower back pain can lead to chronic issues, affecting workers' health and performance.

iv. **Shoulder Pain:** The most prevalent discomfort, reported by thirty-six workers (69.2%), is shoulder pain. This may result from repetitive overhead movements, prolonged static positions, or lifting heavy loads. Addressing this requires ergonomic adjustments, task rotation, and exercises to relieve strain and strengthen the shoulder muscles.

v. **Elbow:** Twelve workers (23.1%) reported elbow pain or discomfort. This is often linked to repetitive tasks requiring arm movement or improper handling of tools. Interventions such as providing supportive tools and encouraging task variation can help reduce strain on the elbows.

vi. Wrist/Hand Pain: Twenty workers, representing 38.5%, reported wrist or hand discomfort. This issue is frequently associated with repetitive hand movements or poor workstation design. Solutions include ergonomic tools, wrist support, and stretching exercises to alleviate pain and prevent long-term conditions like carpal tunnel syndrome.

vii. Hips/Thighs Pain: Thirty-six workers (69.2%) experienced pain in the hips or thighs, reflecting a high prevalence. This may be linked to prolonged standing, awkward postures, or heavy lifting. Providing supportive seating, encouraging movement breaks, and improving task design are key to reducing this discomfort.

viii. Knee Pain: Twenty-eight workers (53.8%) reported knee pain or discomfort. This can stem from tasks requiring frequent kneeling, heavy lifting, or extended standing. Proper footwear, knee pads, and task modifications can alleviate strain and prevent further injury.

ix. Ankles/Feet Pain: Thirty-two workers (61.5%) reported pain or discomfort in their ankles or feet. This is often caused by prolonged standing, inadequate footwear, or physically demanding tasks. Providing supportive footwear and opportunities for rest can help address this issue and improve worker comfort.

Risk Assessment

Table 4 shows the final risk scores for the HCWs. Critical risks demand immediate action to prevent severe consequences.

a. Critical risks: For instance, the presence of water on the floor poses an 11.5% critical risk, making it essential to restrict access to wet areas and address pooling water immediately through frequent mopping and improved drainage. Similarly, bad equipment at 3.8% critical risk should be repaired or replaced promptly, with access to malfunctioning tools restricted until the hazard is mitigated. Though the critical risks for heavy egg boxes (3.8%), unguarded belts (0%), and naked wires (0%) are lower, preventive measures should still be considered to avoid escalation.

Table 4: Final Risk Score

Risks	Descriptor	Number of occurrences	% Exposure Level
	Very low	2	3.8
	Low	6	11.5
Water on the Floor	Medium	21	40.4
	High	17	32.7
	Critical	6	11.5
	Very low	6	11.5
	Low	10	19.2
Heavy Egg Boxes	Medium	32	61.5
	High	2	3.8
	Critical	2	3.8
	Very low	18	34.6
	Low	6	11.5
Bad Equipment	Medium	13	25.0
	High	13	25.0
	Critical	2	3.8
	Very low	24	46.2
	Low	10	19.2
Unguarded belt	Medium	12	23.1
	High	6	11.5
	Critical	0	0.0
	Very low	12	23.1
	Low	10	19.2
Naked wire	Medium	16	30.8
	High	14	26.9
	Critical	0	0.0

b. **High risks** require swift action within 1-2 days to minimize harm. Water on the floor shows a significant 32.7% high-risk level, emphasizing the need for effective floor maintenance protocols to prevent accidents. Electrical hazards, such as naked wires (26.9% high risk), also demand immediate attention, such as insulating wires or rewiring to prevent shocks or fire incidents. Similarly, unguarded belts (11.5% high risk) should be covered promptly to reduce the risks of entanglement. While heavy egg boxes show a relatively low high-risk percentage (3.8%), ergonomic interventions like mechanical lifting aids and training should be introduced to safeguard workers.

c. **Medium risks**, such as heavy egg boxes (61.5%) and water on the floor (40.4%), highlight the need for action within the week. Addressing the ergonomic challenges of lifting heavy egg boxes through mechanical aids or reassigning tasks can reduce the physical strain on workers. Moderate risks posed by bad Equipment (25.0%), unguarded belts (23.1%), and naked wires (30.8%) stress the importance of timely repairs and maintenance. For example, ensuring electrical hazards are minimized through regular inspections and protective measures can significantly reduce risks.

d. **Low risks**, which can be addressed within a reasonable timeframe of 2-4 weeks, include issues like water on the floor (11.5%) and bad Equipment (11.5%). These hazards can be mitigated through routine maintenance schedules and increased awareness among staff. For heavy egg boxes with a 19.2% low risk, training workers on proper lifting techniques and considering automation as a long-term goal can help reduce risks further. Low risks associated with unguarded belts (19.2%) and naked wires (19.2%) still require attention to prevent hazards from escalating over time.

e. **Very low risks** are those that should be eliminated or reduced when possible, but do not pose immediate threats. Among the workers, 46.2% of the HCWs were at very low risk of unguarded belts, suggesting that while urgent action may not be required, preventive measures such as routine inspections and gradual upgrades are important. For Bad Equipment, 31.25% of the HCWs were at very low risk of the HCWs while 25% of the HCWs were at very low risk of the naked wires. Also, fall into this category, underscoring the importance of regular maintenance and proactive safety measures.

Postural Analysis with REBA

The postural analysis results using REBA, as shown in Table 5, indicate that no HCWs were seen in the risk level of "none". This suggests that there are no postures in the assessment that pose a negligible risk. However, maintaining proper ergonomic practices will ensure such a negligible risk level. Six HCWs (11.5%) were within the low-risk level. While changes may not be immediately necessary, the workers should be monitored for potential improvements. Modifications for improvements of the work activities to reduce strain further could include minor adjustments in work technique, posture support, or tool design to enhance comfort and efficiency. The majority of the HCWs (88.5%) fell into the medium-risk level, indicating that changes are necessary to minimize ergonomic risks. This high proportion underscores the need for targeted interventions.

Table 5: Final REBA Score

Score	Frequency	Percentage (%)
1	0	0
2-3	6	11.5
4-7	46	88.5
8-10	0	0
11+	0	0

CONCLUSION AND RECOMMENDATIONS

Based on the comprehensive analysis of risks and posture of HCWs at Awe, Oyo state, the findings highlight a workplace with manageable but significant risks that require varying levels of intervention to ensure safety. Critical risks, such as water on the floor and bad Equipment, demand immediate action to prevent severe accidents. High risks, including exposed electrical wires and unguarded belts, also require prompt mitigation to protect workers. Moderate risks, such as lifting heavy egg boxes and addressing medium-level hazards like equipment malfunctions, must be systematically addressed within a short timeframe to reduce the likelihood of harm. The outcome of this research is in line with the report of Carvalho *et. al.,* 2015, which supported that hatchery workers are exposed to some unhealthy working conditions. Therefore, regular maintenance of machinery and the provision of personal protective equipment can mitigate these effects.

However, based on the findings in this research, the following recommendations are proposed to enhance the health, safety, and productivity of HCWs in Nigeria:

i. To address the issue of water on the floor, it is recommended to implement frequent cleaning schedules and install anti-slip mats in high-risk areas to prevent accidents caused by wet surfaces. Additionally, routine inspections should be conducted to ensure that proper drainage systems are functioning effectively, thereby reducing the chances of water accumulation.

ii. To manage the risk associated with lifting heavy egg boxes, mechanical lifting aids or trolleys should be introduced to minimize physical strain on workers. Training programs on safe lifting techniques and ergonomic practices are also essential to equip employees with the skills needed to handle heavy loads safely.

iii. Exposed machinery belts require the installation of protective guards to eliminate risks of entanglement or injury. Workers should be trained on the proper operation of guarded equipment to ensure safe practices are maintained during their tasks. Similarly, naked electrical wires should be repaired or replaced immediately, with regular electrical safety audits implemented to identify and address potential hazards. Providing insulated tools and gloves for workers in high-risk areas is also crucial for ensuring their safety.

iv. Workstations should be redesigned to ensure tools and materials are within easy reach, and adjustable seating or workstations should be provided to reduce physical strain. Regular training sessions on posture correction and safe work practices will further support employees in minimizing ergonomic risks and improving workplace comfort.

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