



FACULTY OF HEALTH SCIENCES

UNIVERSITY OF CAPE TOWN

Occupational health risks and airways disease in Tanzanian seaweed harvesting and processing environments

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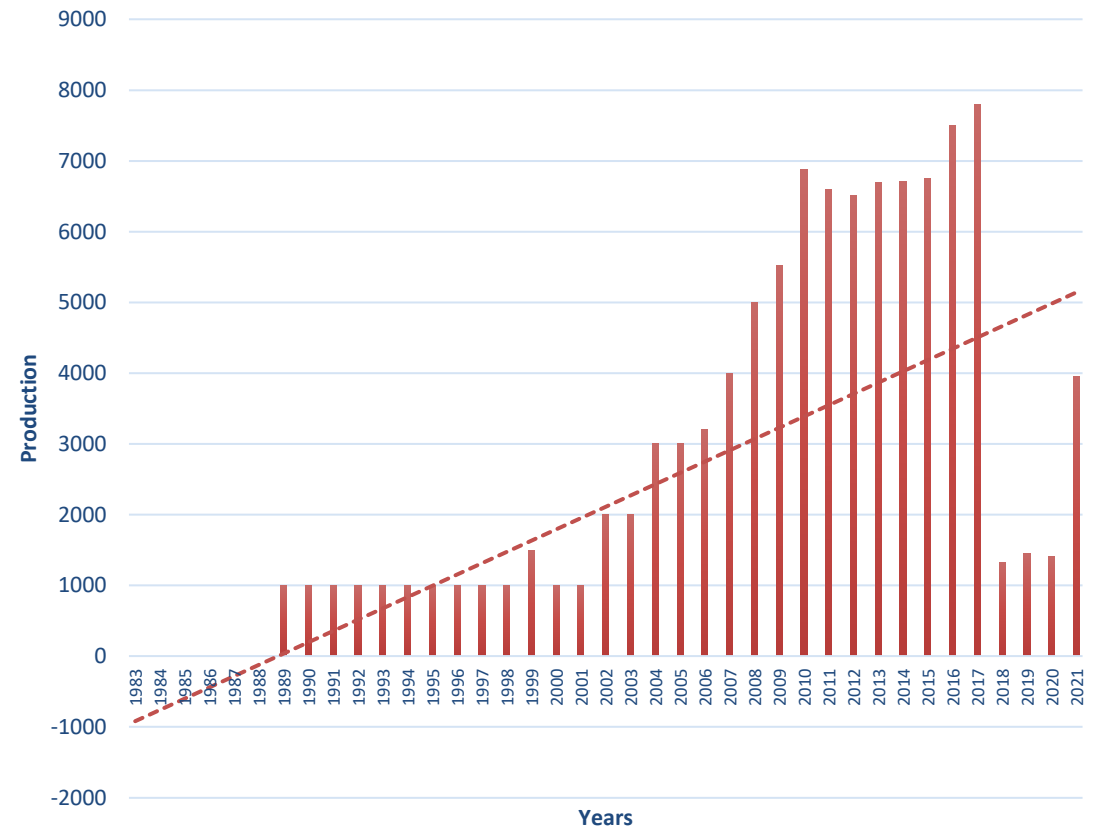
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Background

- Seaweed farming, initiated in Zanzibar in 1989, has emerged as a cornerstone of the region's economy
- Zanzibar ranks as the third-largest seaweed producer globally, with a substantial portion of its harvest destined for international markets
- Limited information exists regarding the occupational health risks among workers engaged in seaweed handling

Temporal trends in Tanzanian seaweed production



FAO. 2020. FAO Fisheries and Aquaculture - FishStatJ - Software for Fishery and Aquaculture Statistical Time Series. In: FAO Fisheries and Aquaculture Division [online]. Rome

Objectives

- To determine the geospatial distribution of seaweed farms in Zanzibar, Tanzania
- To investigate potential occupational hazards and evaluate high risk exposures among seaweed farmers
- To determine the prevalence of adverse work-related musculoskeletal, respiratory and dermatological health outcomes in seaweed farmers
- To determine the presence of airways disease in farmers



Materials and Methods



Study design: A cross-sectional study conducted across three regions of Zanzibar to map seaweed co-operatives (n=45), assess occupational hazards and associated interventions across sites (n=24), and evaluate the health of Zanzibari individual seaweed workers (n=602).

Data collection: Data collected through focused worksite hazard evaluations and interviewer-administered questionnaires accompanied by spirometry using a portable EasyOne spirometer according to ATS/ERS Guidelines.

Results

Demographic, housing, income and health characteristics of seaweed farmers

Demographic characteristics	Prevalence (%) n = 602
Age (years) [median (IQR)]	50 (41-57)
Sex (female:male)	91: 9
Smoking status: n (%)	
• Current smoker	0 (0)
• Ex-smoker	2 (0.3)
• Never smoker	600 (99.7)
Seaweed farming as a primary source of income	594 (99)
Average income per year (USD)*	240 (144-385)
Main type of fuel used for cooking	
• Firewood	554 (92)
• Other (Charcoal, electricity, bottled gas, crop residuals, straw, grass)	48 (8)
Cooking place	
• In house	596 (99)
• In separate building	2 (0.3)
• Outdoors	4 (0.7)
Family history of allergy	46 (8)



Production, location and workforce characteristics of seaweed farming co-operatives enumerated in Zanzibar, Tanzania

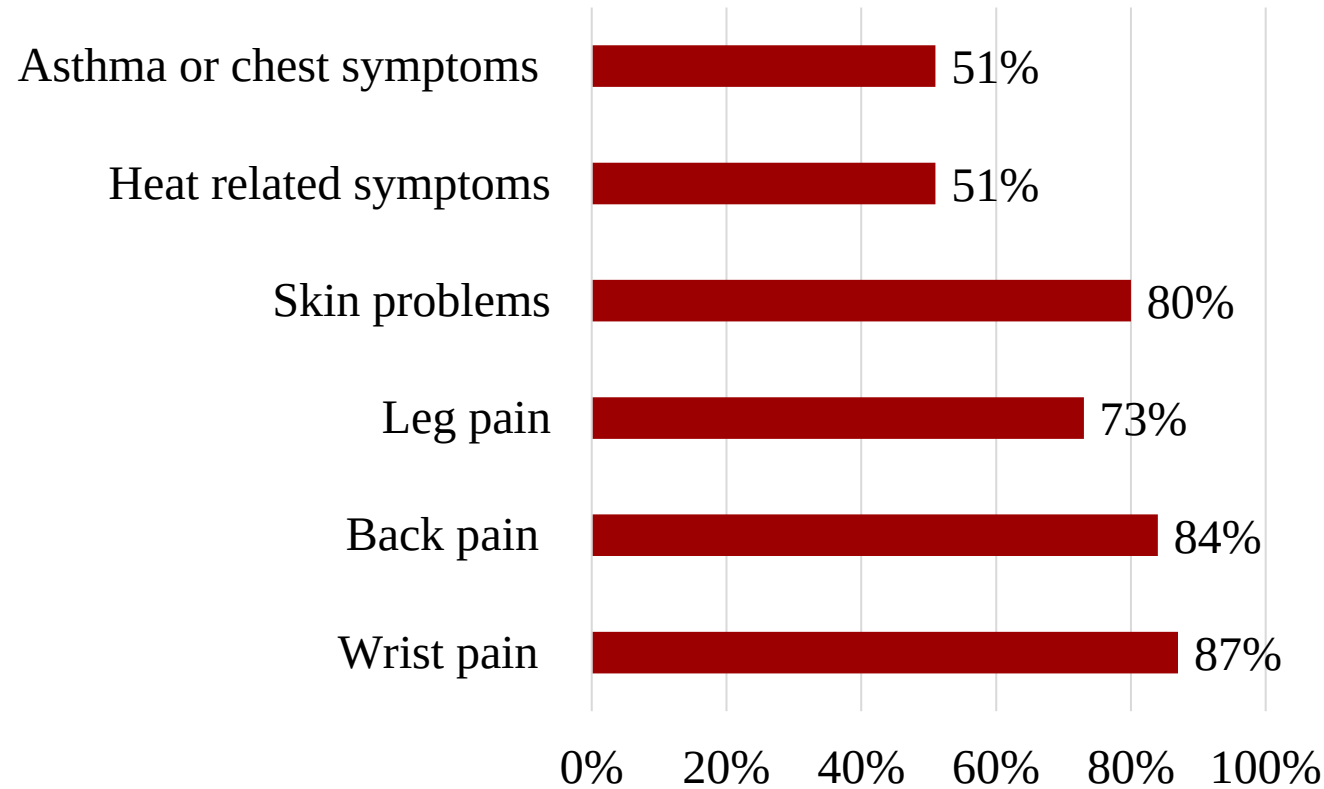
Characteristic (n=45)	n (%)
Seaweed species farmed	
• <i>Eucheuma Cottonii</i>	4 (9%)
• <i>Eucheuma Spinosum</i>	45 (100%)
Production per month (kg)	100 (75-150)
Location of the farming regions	
• Unguja South	20 (44%)
• Unguja North	15 (33%)
• Mjini Magharib	10 (22%)
Farming cooperatives engaged in drying of seaweed	45 (100%)
Farming cooperatives engaged in other forms seaweed processing methods (cooking, making soap, making body lotions, making food items)	4 (9%)
Number of workers per cooperative in a village	15 (12-25)
• Number of men per cooperative	1 (0-2)
• Number of women per cooperative	15 (12-21)



Common occupational hazards identified in Seaweed Farming

Hazard category	Causative agents/processes	Health Effect(s)
Ergonomics	Repetitive movements, awkward postures, heavy lifting, force use, long-distance walking	Musculoskeletal disorders, fatigue
Chemical	Sodium hydroxide, irritants in soap making, toxic gases from marine algae	Chemical burns, skin irritation, dermatitis, asthma, respiratory irritation, eye irritation
Biological	Marine micro-organisms, seaweed dust, endotoxins, mould	Dermatitis, asthma, rhino-conjunctivitis, chest infection, hypersensitivity pneumonitis
Physical	Solar radiation, high temperature, noise, glare, wet work	Skin damage, heat-related illnesses, hearing loss, visual discomfort
Safety	Sharp shells, marine organisms, working in deep waters, poor electrical installation, slips, trips, falls	Cuts, stings, drowning, electrocution, fractures
Psychosocial	High-demand work, poor work-life balance, seaweed die-offs	Stress-related symptoms, fatigue

Common work-related symptoms reported by seaweed workers



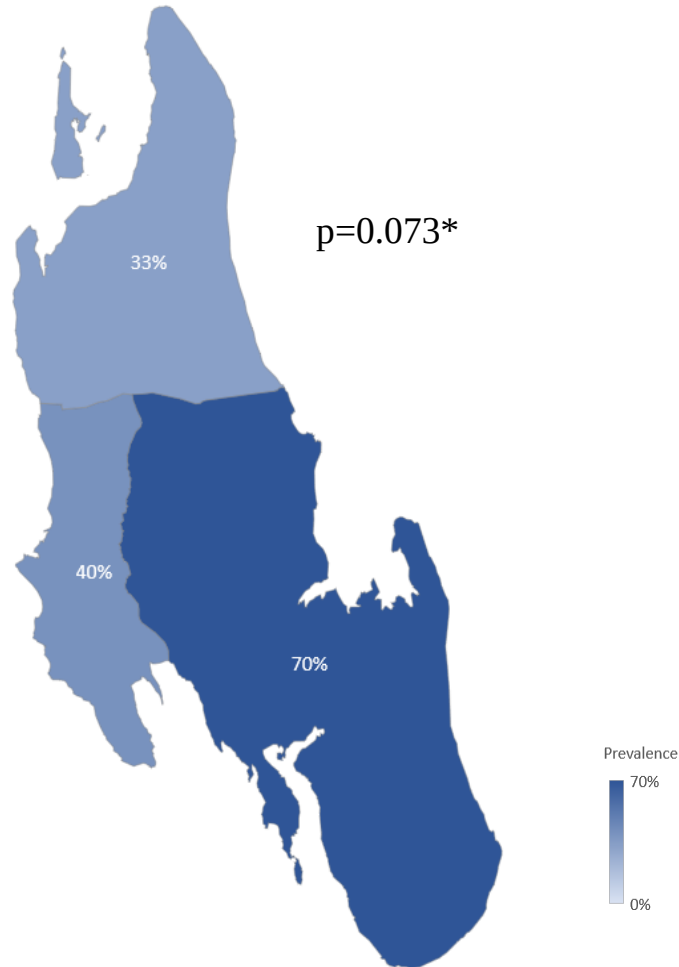
**Results are presented as percentage of responding farming cooperatives, n=45*



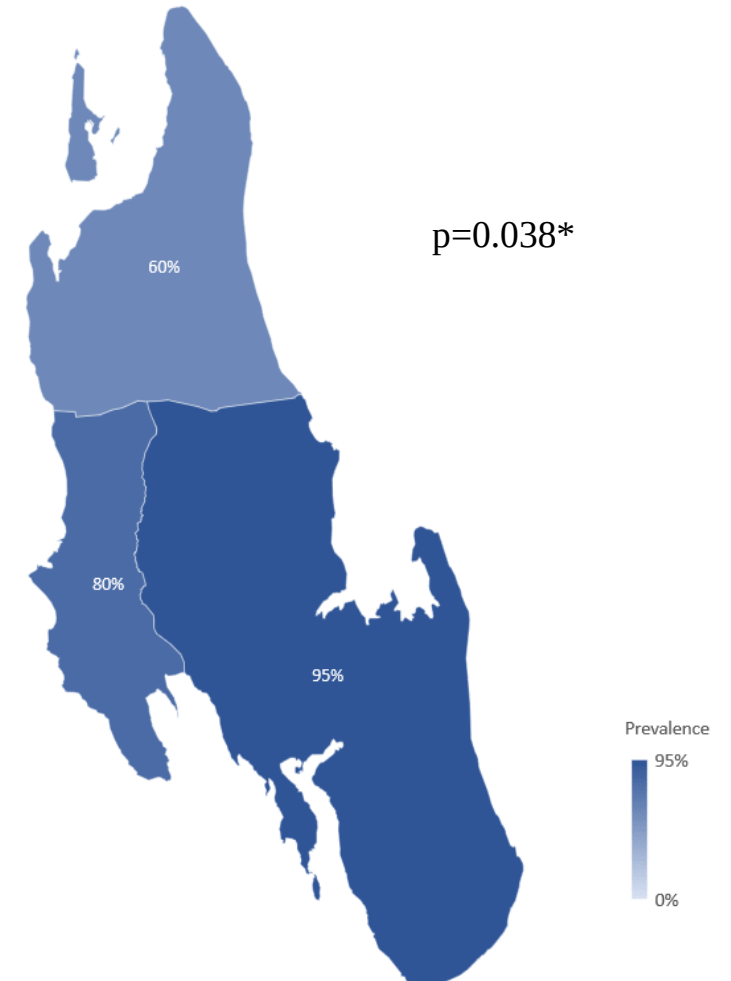
At least half the workers had **asthma** or **chest**-related symptoms

Geo-spatial patterns of common work-related symptoms

Asthma-related symptoms



Skin-related symptoms

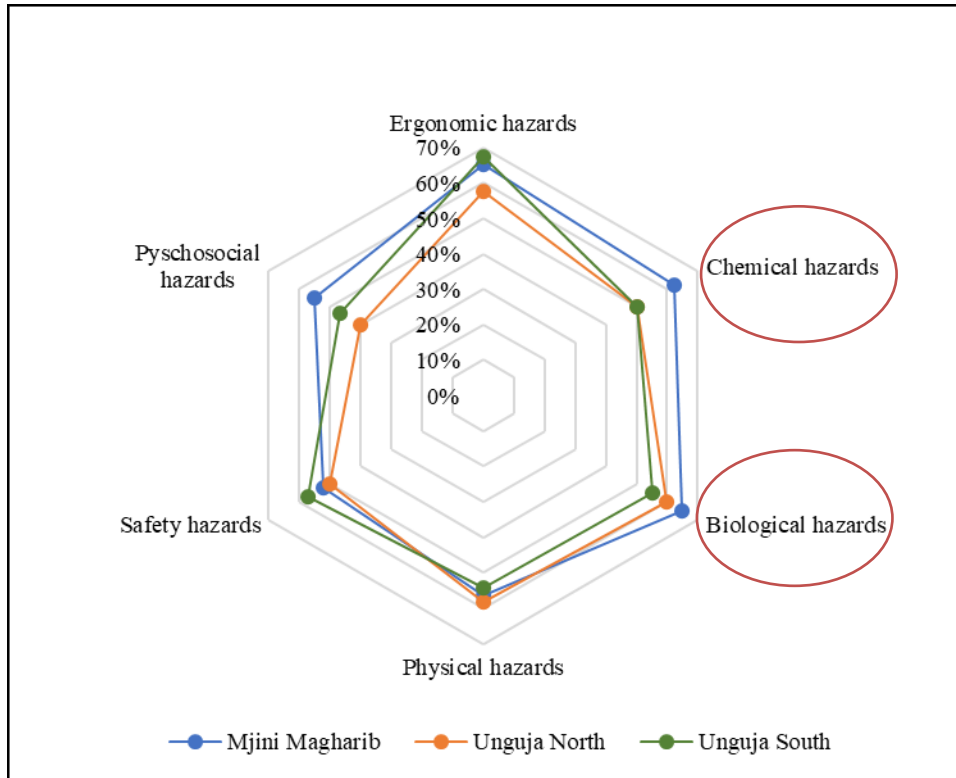


* *Chi-square test*

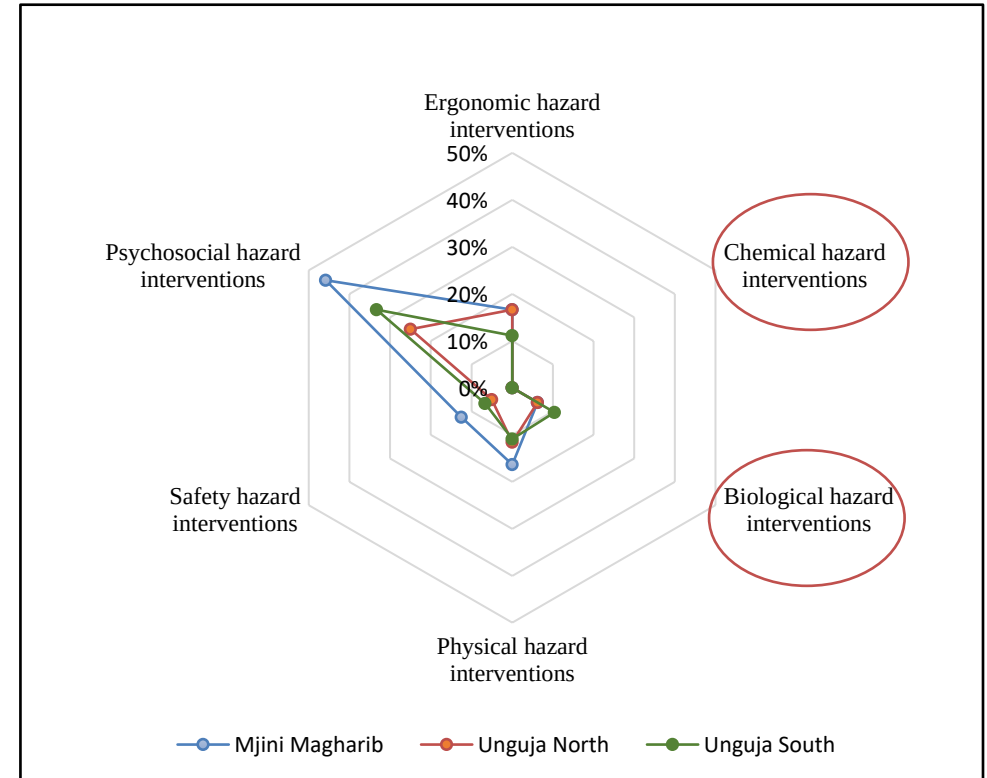
The prevalence of work-related symptoms among seaweed workers demonstrates geospatial variations, with **Mjini Magharib** and **Unguja South** exhibiting higher rates of asthma and skin symptoms compared to Unguja North.

Occupational hazards and interventions in seaweed farming cooperatives

Mean occupational hazard scores (%)



Comparative mean intervention scores (%)



Mjini Magharib has high hazard scores but low intervention scores for chemical and biological hazards compared to other regions

Respiratory symptoms reported by individual seaweed workers

Symptoms	Prevalence (%) n = 602
Presence of ocular-nasal symptoms ever	266 (44)
Asthma-related symptoms*	
• More symptomatic (≥ 2 asthma-related symptoms)	102 (17)
• Less symptomatic (0 – 1 asthma-related symptom)	500 (83)
Work-related chest symptoms (ever)	51 (8)
Causes of chest symptoms	
• Physical exertion	37 (6)
• Raw seaweed	20 (3)
• Seaweed dust	7 (1)
• Other (e.g., caustic soda, soap, cold)	11 (2)
Work related symptoms suggestive of organic dust toxic syndrome (ODTS)	20 (3)

**Wheezing in the past 12 months; Shortness of breath while wheezing in the last 12 months; Woken up with chest tightness in the last 12 months; Attack of shortness of breath at rest during daytime in the last 12 months; Attack of shortness of breath following running or exercise in the last 12 months; Woken up by an attack of shortness of breath in the last 12 months*



Grinding seaweed to powder



Pouring seaweed powder, sodium hydroxide and fragrances



Mixing all ingredients for making soap

Pulmonary function indices of seaweed workers

Pulmonary function indices * #	Prevalence (%) n=416
FEV ₁ L ± SD	1.81 ± 0.54
FVC L ± SD	2.35 ± 0.67
FEV ₁ % pred. [median (IQR)]	85 (71-96)
FVC % pred. [median (IQR)]	89 (75-101)
FEV₁ < LLN	130 (31)
FEV ₁ < 80% pred.	171 (41)
FVC < LLN	106 (25)
FVC < 80% pred.	131 (31)
FEV ₁ /FVC [median (IQR)]	79 (72-84)
FEV₁ /FVC < LLN	83 (20)
FEV₁ /FVC < 70%	76 (18)

FEV₁: forced expiratory volume in 1 second; FVC: forced vital capacity; L: litres;
 LLN: Lower limit of normal; IQR: interquartile range; SD: Standard deviation;
 % pred: % predicted , #: Global lung function initiative (GLI12 - other) reference values



18-20% have airway obstruction suggestive of Asthma/COPD

Conclusion

- Seaweed harvesting and processing is associated with diverse occupational hazards, including biological (e.g. biomass fuel burning, raw seaweed) and chemicals (e.g. caustic soda, fragrances) used in processing, contributing to an increased risk of asthma.
- Asthma disease burden is high, 17% having asthma-related symptoms and 18-20% with airway obstruction. Future research focus on identifying the specific causes of airways disease in these workers.
- Notable geographical patterns in symptoms, occupational hazards and interventions exist. May be related to better seaweed processing infrastructure in Unguja North and South regions, since a higher prevalence of workers report receiving OHS training compared to the Mjini Magharib region.
- Tailored interventions focussing on improved work practices key to improving OHS in general and respiratory health of workers in particular.