



Laboratory of Scientific Innovation in
Sustainability, Environment, Education
and Health in the era of AI



Sidi Mohamed Ben Abdellah University
Higher School of Education
Fez



ORGANIZE

1st INTERNATIONAL CONGRESS (EPIA-1)

Epidemiology in the age of AI

Conferences - Communications - Workshops



Fez, Morocco



June 29-30 & July 1 - 2026

In collaboration with partners:



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THE PROCEEDINGS BOOK

Edited by

Prof. Saad BENAMAR

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المدرسة العليا للأساتذة بفاس
جامعة محمد السادس بأكادير
École Normale Supérieure de Fès

THE PROCEEDINGS BOOK

FIRST INTERNATIONAL CONGRESS ON EPIDEMIOLOGY IN THE AGE OF AI

June 29-30 & July 1, 2026 / Fez, MOROCCO

THE PROCEEDINGS BOOK EDITOR

Prof. Saad BENAMAR

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THE PROCEEDINGS BOOK

CONGRESS TITLE

1th INTERNATIONAL CONGRESS: EPIDEMIOLOGY IN THE AGE OF AI

CONGRESS ACRONYM

EPIA-1

CONGRESS THEMES

Theme 1: Epidemiology of Addictions

Theme 2: Epidemiology of Cancers

Theme 3: Epidemiology of Vector-Borne Diseases

DATE AND PLACE

June 29 -30 & July 1, 2026 – Fez, Morocco

PRESENTATION

In Person

ORGANIZATION

**Laboratory of Scientific Innovation in Sustainability, Environment,
Education and Health in the era of AI**

Sidi Mohamed Ben Abdellah University; Higher School of Education; Fez, Morocco

CONGRESS PRESIDENT

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COORDINATORS

Theme 1 : Prof. Btissame ZARROUQ, USMBA, Fez, Morocco

Theme 2 : Prof. Souad GUERNAOUI, USMBA, Fez, Morocco

Theme 3 : Prof. Khaoula EL KINANY, ISPITS, Fez, Morocco

PLENARY LECTURES NUMBER: 17

ORAL COMMUNICATIONS NUMBER: 54 (Rejected papers: 17)

WORKSHOPS NUMBER: 6

EVALUATION PROCESS:

All applications have undergone a double-blind peer review process



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PLENARY LECTURES PROGRAM

June 29, 2026

OPENING PLENARY LECTURE SESSION

SESSION CHAIR: Pr. Karima EL RHAZI

Plenary Speaker	Organization	Theme	Plenary Lecture Title	Time
Pr. Chakib NEJJARI	EMED-Fès, Morocco	T2		
		Cancer	Épidémiologie des cancers : évolutions et tendances récentes	11h00 - 11h30
		[Conf T2-1]		
Pr. Souheil HALLIT	USEK, Lebanon	T1		
		Addictions	Heated Tobacco Products and Health: The Good, the Bad, and the Addiction Problem	11h30 - 12h00
		[Conf T1-1]		
Dr. Denis SERENO	IRD, Montpellier-France	T3		
		Vector-Borne Diseases	Un atlas d'insectes d'intérêt médical et vétérinaire basé sur les patrons de couleur interférentielle des ailes (WIP) et l'intelligence artificielle : une approche interprétable en classes ouvertes pour l'identification et l'inférence des traits	12h00 - 12h30
		[Conf T3-1]		

THEME 1: EPIDEMIOLOGY OF ADDICTIONS

COORDINATOR: Pr. Btissame ZARROUQ

■ Session T1-1: Cannabis Use: From Psychotic Risk to Innovative Prevention and Screening Approaches
June 29, 2026

HEAD OF SESSION: Pr. Abdelghaffar EL AMMARI

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
Pr. Feten FEKIH-ROMDHANE	Faculté de Médecine, Tunisia	[Conf T1-2]	
		Usage de cannabis en population générale : Quel risque de développer une psychose ?	14h30 - 15h00
		Cannabis use in the general population: what risk of developing psychosis?	



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■ Session T1-3: Neuroscience and Addiction Prevention: Emerging Research Perspectives and Interventions

June 30, 2026

HEAD OF SESSION: Pr. Karima MRIZIK

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
Pr. BOUT Amine	FMPMD-Fès, Morocco	[Conf T1-3] Neurobiologie des addictions <i>Neurobiology of addictions</i>	09h00 - 09h30
Pr. Btissame ZARROUQ	ENS-Fès, Morocco	[Conf T1-4] Addiction chez les jeunes marocains : de la recherche épidémiologique observationnelle à l'interventionnelle <i>Addiction among young Moroccans: from observational epidemiological research to interventional research</i>	09h30 - 10h00

■ Session T1-5: Behavioral Addictions and Digital Usages: Impacts on Mental Health and Therapeutic Perspectives

June 30, 2026

HEAD OF SESSION: Pr. Khalid TISSIR

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
Pr. Imane TAOUFIQ	Université Hassan II, Casablanca-Morocco	[Conf T1-5] Rituels, comportements et addictions : perspectives thérapeutiques <i>Rituals, behaviors, and addictions: therapeutic perspectives</i>	14h30 - 15h00

THEME 2: EPIDEMIOLOGY OF CANCERS

COORDINATOR: Pr. Khaoula EL KINANY

■ Session T2-1: Healthcare of Tomorrow: Epidemiological Transition, Artificial Intelligence, and Personalized Medicine

June 29, 2026

HEAD OF SESSION: Pr. Majid OMARI

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
Pr. Mohamed Amine BERRAHO	IRC, Morocco	[Conf T2-2] Changes in cancer morbidity patterns in Morocco and their implications for the health care system and scientific research	14h30 - 15h00
Dr. Inge HUYBRECHTS	CIRC/OMS, Lyon-France	[Conf T2-3] Sustainable lifestyle and health in the Age of Artificial Intelligence.	15h00 - 15h30





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Pr. Zineb BENBRAHIM

FMPMD, Fès, Morocco

[Conf T2-4] Médecine personnalisée et prise en charge des cancers colorectaux au Morocco.

15h30

-

16h00

Personalized medicine and management of colorectal cancers in Morocco.

■ Session T2-3:

Artificial Intelligence and Cancer Prevention

June 30, 2026

HEAD OF SESSION: Pr. Hanaa Ait-Taleb Lahsen

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
Dr. Farida SELMOUNI	CIRC/OMS, Lyon-France	[Conf T2-5] Utilisation de l'intelligence artificielle (chatbot) pour améliorer la participation des femmes vivant dans des zones défavorisées au dépistage du cancer du col de l'utérus. <i>Use of artificial intelligence (chatbot) to improve participation of women living in underserved areas in cervical cancer screening.</i>	09h00 - 09h30

■ Session T2-5:

Health Promotion and Female Cancers

June 30, 2026

HEAD OF SESSION: Pr. Noura Qarmiche

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
Pr. Ruben MARTIN-PAYO	Département de Médecine-Oviedo Univ-Espagne	[Conf T2-6] Use a web-app to improve breast cancer risk factors and symptoms knowledge and adherence to healthy diet and physical activity in women without breast cancer diagnosis (Precam project).	14h30 - 15h00

THEME 3: EPIDEMIOLOGY OF VECTOR-BORNE DISEASES

COORDINATOR: Pr. Souad GUERNAOUI

■ Session T3-1:

Medical Malacology, Molluscan Vectors, and Trematodiasis

June 29, 2026

HEAD OF SESSION: Pr. Oumnia HIMMI

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
Pr Mohamed GHAMIZI	FSSM Marrakech, Morocco	[Conf T3-2] Les Mollusques Hôtes Intermédiaires ou Vecteurs des Trématodes (Parasites des Vertébrés) : Stratégies ou Intelligence Naturelle? <i>Molluscan intermediate hosts or vectors of trematodes (vertebrate parasites): strategy or natural intelligence?</i>	14h30 - 15h00





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■ Session T3-3: Technology-Driven Vector Surveillance and Reference Collections June 30, 2026 HEAD OF SESSION: Pr. Mohamed GHAMIZI

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
Dr. Phillippe HOLZMULLER	CIRAD-Montpellier, France	[Conf T3-3] Méta-protéomique des tiques : Raconter l'histoire moléculaire d'un écosystème vectoriel complexe pour relier taxonomie, physiologie parasitaire, microbiote et transmission d'agents pathogènes <i>Tick metaproteomics: telling the molecular story of a complex vector ecosystem linking taxonomy, parasite physiology, microbiota and pathogen transmission</i>	09h00 - 09h30

■ Session T3-4: Vector-Borne and Parasitic Pathologies in Domestic Animals June 30, 2026 HEAD OF SESSION: Pr. Mohamed GHAMIZI

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
Pr Maria BOURQUIA	IAV Hassan II, Rabat, Morocco	[Conf T3-4] Les maladies Vectorielles chez les Animaux Domestiques au Maroc : Situation Epidémiologique et Enjeux. <i>Vector-borne diseases in domestic animals in Morocco: epidemiological situation and challenges.</i>	11h15 - 11h45

■ Session T3-5: Epidemiology and Spatiotemporal Modeling of Cutaneous Leishmaniasis June 30, 2026 HEAD OF SESSION: Dr. Denis SERENO

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
Pr Souad GUERNAOUI	FSDM Fes, Morocco	[Conf T3-5] Défis liés à la lutte contre la leishmaniose cutanée au Maroc : Ecologie et génétique des vecteurs pour des stratégies potentielles pour aller de l'avant. <i>Challenges in combating cutaneous leishmaniasis in Morocco: vector ecology and genetics for potential ways forward.</i>	14h30 - 15h00

■ Session T3-7: One Health Approach and Predictive Epidemiological Modeling July 1, 2026 HEAD OF SESSION: Pr. Abderrahmane ZAHRI

Plenary Speaker	Organization(s)	Plenary Conference Title	Time
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Pr Mohamed
ECHCHAKERY

ISSS Settat, Morocco

[Conf T3-6] Leishmaniasis in Central-
Western Morocco: One Health Diagnosis of
Transmission Drivers Rodents, Vectors,
Humans and Environment

09h00
-
09h30



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ORAL COMMUNICATIONS PROGRAM

THEME 1: EPIDEMIOLOGY OF ADDICTIONS

COORDINATOR: Pr. Btissame ZARROUQ

■ Session T1-1:

June 29, 2026

15h15 - 16h00

Cannabis Use: From Psychotic Risk to Innovative Prevention and Screening Approaches

HEAD OF SESSION: Pr. Abdelghaffar EL AMMARI

Author(s)	Organization(s)	Communication Title
Abdelilah ELHACHIMI	Cadi Ayyad University, Marrakesh, Morocco	[COT1-1] Epidemiological profile of cannabis addiction among young people in Marrakech and its prediction using artificial intelligence techniques
Anass HAIMOUNI	Sidi Mohamed Ben Abdellah University - Fez Morocco	[COT1-3] From denial to awareness: exploring the shift from precontemplation to contemplation of cannabis use disorder in young people with ADHD

■ Session T1-2:

June 29, 2026

16h45 - 17h45

Tobacco and Alcohol Use: Epidemiological, Psychometric, and Preventive Approaches

HEAD OF SESSION: Pr. Abdelghaffar EL AMMARI

Author(s)	Organization(s)	Communication Title
Abdelfettah EL-AMMARI ¹ Abdelghaffar EL-AMMARI ² Salma Ghofrane MOUTAWAKKIL ¹ Hicham EL KAZDOUH ³ Btissame ZARROUQ ¹	¹ Sidi Mohamed Ben Abdellah University, Fez, Morocco ² National School of Public Health, Rabat, Morocco ³ Regional Center for Education and Training Professions, Tanger, Morocco	[COT1-4] Tobacco Advertising Exposure and Adolescent Tobacco Use in Morocco: A Latent Class Analysis
Asmae BAHAOUI Amine ZARROUK Hanane ISSAOUI Mariam ATTASSI Naima ABDA	Mohammed Premier University Oujda, Oujda, Morocco	[COT1-5] Factors associated with the failure of smoking cessation attempts in Oujda
Kenza KASSAB ¹ Deyae ZERROUK ¹ Achraf EL ASRI ² Btissame ZARROUQ ¹	¹ Sidi Mohamed Ben Abdellah University, Fez, Morocco ² Higher Institute of Nursing Professions and Health Techniques, Fez, Morocco.	[COT1-7] Motives for alcohol use among university students in the Middle East and North Africa region: Insights from a Systematic Review

■ Session T1-3:

June 30, 2026

10h15 - 10h45

Neuroscience and Addiction Prevention: Emerging Research Perspectives and Interventions

HEAD OF SESSION: Pr. Karima MRIZIK

Author(s)	Organization(s)	Communication Title
Abdelmounaim BASLAM	Sidi Mohamed Ben Abdellah University, Fez, Morocco	[COT1-8] Gut Microbiota and Addiction: Toward a New Understanding of the Gut-Brain Axis

■ Session T1-4:

June 30, 2026

11h15 - 12h45

Addictions, Risk Behaviors, and Mental Health: Emerging Challenges and Research Innovations

HEAD OF SESSION: Pr. Abdelmounaim BASLAM

Author(s)	Organization(s)	Communication Title
Lamyae BENYOUSSEF	Mohammed V University, Rabat, Morocco	[COT1-10] Cocaine Use Disorder: Working Memory Impairment and Clinical Management
Aziza EL KAFSI ^{1,2} Nadia MOUNTAJ ^{2,3} Hajar EL OMARI ^{2,4} Karima EL MOUHDI ^{2,4} Khaoula EL KINANY ^{1,5} Btissame ZARROUQ ¹	¹ Sidi Mohammed Ben Abdallah University, Fez, Morocco ² Higher Institute of Nursing Professions and Health Techniques, Meknes, Morocco ³ Ibn Tofail University, Kenitra, Morocco ⁴ Moulay Ismail University, Meknes, Morocco ⁵ Higher Institute of Nursing Professions and Health Techniques, Fez, Morocco	[COT1-11] Risky Dietary Behaviors and ChatGPT Use among Nursing Students in Morocco: A Cross-Sectional Study
Fatima Zahrae BARTAL Noura QARMICHE Soumaya BENMAAMAR Ibtissam EL HARCH Samira EL FAKIR Karima EL RHAZI	Sidi Mohamed Ben Abdallah University, Fez, Morocco	[COT1-12] Artificial Intelligence Applications in Addictive Eating Behaviors and Ultra-Processed Food Consumption: A Scoping Review

■ Session T1-5:

June 30, 2026

15h00 - 15h45

Behavioral Addictions and Digital Usages: Impacts on Mental Health and Therapeutic Perspectives

HEAD OF SESSION: Pr. Khalid TISSIR

Author(s)	Organization(s)	Communication Title
Sofia EL YAHYAOU ^{1,2} Salma LABYAD ³ Zainab LHASSANI ³ Fatima OUASMANI ^{2,3}	¹ Higher Institute of Nursing Professions and Technics of Health (ISPITS) of Kenitra - Morocco ² Ibn Tofail University, Kenitra, Morocco	[COT1-14] Smartphone addiction and students' mental health: A correlational study



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Morocco

Samira BOUAZZA
Samira ABOUYI
Btissame ZARROUQ

Sidi Mohamed Ben Abdellah
University, Fez, Morocco

[COT1-15] Problematic smartphone use and dry eye disease: what is the association among Moroccan adolescents?

■ Session T1-7:

July 1, 2026

09h00 - 09h45

Screens, Video Games, and Artificial Intelligence: From Child Development to Adolescent Mental Health

HEAD OF SESSION: Pr. Nora QARMICHE

Author(s)

Organization(s)

Communication Title

Deyae ZERROUK
Btissame ZARROUQ

Sidi Mohamed Ben Abdellah
University (USMBA), Fez,
Morocco

[COT1-19] Problematic ChatGPT Use: Validation of the Arabic Version of the PCUS (PCUS-Ar)

Khaoula EL KINANY^{1,2}
Hanaa AIT TALEB
LAHSEN¹
Hanane EL ABED¹
Oumaima LAMRYGUY¹
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[COT1-20] Surexposition aux écrans et retard de langage simple chez l'enfant d'âge préscolaire : étude transversale préliminaire dans la région Fès-Meknès (Maroc)

(Overexposure to screens and simple language delay in preschool children: preliminary cross-sectional study in the Fès-Meknes region (Morocco))

THEME 2: EPIDEMIOLOGY OF CANCERS

COORDINATOR: Pr. Khaoula EL KINANY

■ Session T2-3:

June 30, 2026

09h45 - 10h30

Artificial Intelligence and Cancer Prevention

HEAD OF SESSION: Pr. Hanaa Ait-Taleb Lahsen

Author(s)

Organization(s)

Communication Title

Mohammed FAROUK
Oussama BENTAHAR

Sidi Mohamed Ben Abdellah
University, Fez, Morocco

[COT2-5] Épidémiologie du cancer de la cavité orale au Maroc
(Epidemiology of oral cavity cancer in Morocco)

Safiya MAHLAQ^{1,2}
Ghizlane RAIS³
Meryem MASKROUT³
Sara NACIRI⁴
Hassan ERRIHANI⁴
Redouane ABOUQAL¹
Jihane BELAYACHI¹

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and Health Sciences in
Agadir, Morocco

³ Ibn Zohr University, Agadir,
Morocco

⁴ National Institute of
Oncology, Rabat, Morocco

[COT2-6] Health-related quality of life among women with breast cancer in the Souss-Massa Region: A cross-sectional study



■ **Session T2-4: Psychosocial Determinants in Female Oncology and the Contribution of AI**

June 30, 2026

11h15 - 12h45

HEAD OF SESSION: Pr. Pr. Hanaa Ait-Taleb Lahsen

Author(s)	Organization(s)	Communication Title
Said EL RHABORI ¹ Hicham ZAITAN ¹ Samir CHTITA ² Fouad KHALIL ¹	¹ Sidi Mohamed Ben Abdellah University, Fez, Morocco ² Hassan II University of Casablanca, Casablanca, Morocco	[COT2-9] Artificial intelligence-driven computational biochemistry for advanced cancer drug discovery
Sara NADI ^{1,2} Salima KRIYA ^{1,3} Majid OMARI ⁴ Khaoula EL KINANY ² Farida SELMOUNI ⁵ Richard Muwonge ⁵ Nawfel MELLAS ⁶ Lamiaa AMAADOUR ⁶ Btissame ZARROUQ ¹	¹ Sidi Mohamed Ben Abdellah University, Fez, Morocco ² Higher Institute of Nursing Professions and Health Techniques, Fez, Morocco ³ Higher Institute of Nursing Professions and Health Techniques, Meknes, Morocco ⁴ National School of Public Health (ENSP), Rabat, Morocco ⁵ Early Detection, Prevention and Infections Branch, International Agency for Research on Cancer, Lyon, France ⁶ Hassan II University Hospital, Fez, Morocco	[COT2-10] Longitudinal symptom evolution across three time points in Locally Advanced Breast Cancer
Salima KRIYA ^{1,2} Sara NADI ^{1,2,3} Ibtissam EL MRABET ³ Khaoula EL KINANY ^{1,3} Nawfel MELLAS ^{1,4} Btissame ZARROUQ ¹ Lamiaa AMAADOUR ^{1,4}	¹ Sidi Mohamed Ben Abdellah University, Fez, Morocco ² Higher Institute of Nursing Professions and Health Techniques, Meknes, Morocco ³ Higher Institute of Nursing Professions and Health Techniques, Fez, Morocco ⁴ Hassan II University Hospital, Fez, Morocco	[COT2-11] Coping strategies and treatment response in Moroccan women with locally advanced breast cancer

■ **Session T2-5: Health Promotion and Female Cancers**

June 30, 2026

15h15 - 15h45

HEAD OF SESSION: Pr. Noura Qarmiche

Author(s)	Organization(s)	Communication Title
Majid OMARI ¹ Sara NADI ^{2,3} Salima KRIYA ^{2,4} Khaoula EL KINANY ^{2,3}	¹ National School of Public Health (ENSP), Rabat, Morocco ² Sidi Mohamed Ben Abdellah University, Fez, Morocco	[COT2-13] Prognostic value of initial psychological distress in Moroccan breast cancer patients: metastasis-free survival and overall survival at three years



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³ National School of Public
Health (ENSP), Rabat,
Morocco

**[COT2-14] Women's Satisfaction with Early Cervical
Cancer Screening in Health Centers in Salé: A
Descriptive Cross-Sectional Study**

■ Session T2-7:

01.08.2026

09h00 - 09h45

From Prevention to Patient Support: Healthcare Practices and Psychological Well-Being

HEAD OF SESSION: Pr. Khaoula EL KINANY

Author(s)

Saida ATIK
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National School of Public
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Morocco

Communication Title

**[COT2-16] Prevention of Cervical Cancer:
Knowledge, Attitudes, and Practices among Health
Professionals in Primary Health Care Facilities in
Taza Province**

THEME 3: EPIDEMIOLOGY OF VECTOR-BORNE DISEASES

COORDINATOR: Pr. Souad GUERNAOUI

■ Session T3-1:

June 29, 2026

15h15 - 16h00

Medical Malacology, Molluscan Vectors, and Trematodiasis

HEAD OF SESSION: Pr. Oumnia HIMMI

Author(s)

Fatima BOUZID¹
Mohammed GHAMIZI¹
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Organization(s)

¹ Cadi Ayyad University,
Marrakesh, Morocco
² Sidi Mohamed Ben Abdallah
University, Fez, Morocco

Communication Title

**[COT3-1] Morphometric Polymorphism in Galba
truncatula (Mollusca: Lymnaeidae), Vector of
Fasciola hepatica (Trematoda) in Livestock**

Hassna BEN NABET
Oumayma EL-OGRI
M. AJDI
Souad GUERNAOUI

Sidi Mohamed Ben Abdallah
University, Fez, Morocco

**[COT3-2] Fascioliasis in Central-Northern Regions of
Morocco: Ecology, Vector Distribution, and
Epidemiological Implications**



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Mohamed ABOUDRAR
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University, Fez, Morocco

[COT3-3] Fasciolosis in the Moroccan Middle Atlas region: Current status, challenges and research perspectives.

■ Session T3-2:

June 29, 2026

16h45 - 17h45

Epidemiology of Vector-Borne Diseases and Eco-Friendly Control

HEAD OF SESSION: Pr. Oumnia HIMMI

Author(s)	Organization(s)	Communication Title
Oumayma EL-OGRI H. BENABET S. EL CAIDI Souad GUERNAOUI	Sidi Mohamed Ben Abdallah University, Fez, Morocco	[COT3-4] Freshwater molluscs of medical interest in Fez-Sefrou region, Morocco
Touria FILALI MOUATASSEM ¹ Raja GUEMMOUH ¹ Chafika FARAJ ² Abdellatif ALAMI ¹ Abdelhakim EL OUALI LALAMI ^{1,3}	¹ Sidi Mohamed Ben Abdallah University, Fez, Morocco ² National Institute of Hygiene, Rabat, Morocco ³ Higher Institute of Nursing and Health Technology Professions of Fez, Fez, Morocco	[COT3-6] Proliferation of Mosquitoes (Diptera, Culicidae) that Transmit Infectious Diseases in Northeastern Morocco
Abdellatif ALAMI ^{1,2} Touria FILALI MOUATASSEM ¹ Mohammed OUALI ALAMI ¹ Fatima Zahrae RAD ³ Fatima Zahra TALBI ¹ Mohammed CHRIGUI ²	¹ Sidi Mohamed Ben Abdallah University, Fez, Morocco ² Regional Diagnostic Laboratory of Epidemiological and Environmental Hygiene, Regional Health Directorate, El Ghassani Hospital, Fez, Morocco ³ Higher Institute of Nursing Professions and Technics of Health (ISPITS), Fez, Morocco	[COT3-7] Eco-Friendly Control of Culex pipiens Using Optimized Ternary Mixtures of Moroccan Artemisia Essential Oils

■ Session T3-3:

June 30, 2026

09h30 - 10h30

Technology-Driven Vector Surveillance and Reference Collections

HEAD OF SESSION: Pr. Mohamed GHAMIZI

Author(s)	Organization(s)	Communication Title
Salma BOUZIANE ¹ Manar KABIRI ¹ Imane OUJAJA ¹ Saad AZIZI ¹ Oumnia HIMMI ² Abderrahmane ZAHRI ¹ Maria BOURQUIA ¹	¹ Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, Morocco ² Mohammed V University of Rabat, Scientific Institute, Morocco	[COT3-9] Diversity and ecology of blood-feeding arthropods in poultry farms, urban forests, and a zoological garden: an integrated approach in the Rabat-Casablanca region, Morocco
Yamina DRIOUACH ¹ F. BACHIR ² Maria BOURQUIA ²	¹ Mohammed V University of Rabat, Scientific Institute, Morocco ² Institut de Recherche sur le Cancer	[COT3-10] Taxonomic update and epidemiological analysis of the Ixodidae tick collection from Morocco



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Oumnia HIMMI¹

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■ Session T3-4:

Vector-Borne and Parasitic Pathologies in Domestic Animals

June 30, 2026

HEAD OF SESSION: Pr. Mohamed GHAMIZI

11h15 - 11h45

Author(s)	Organization(s)	Communication Title
Oumaima NAIT HAMMOU ¹ Ghita KARIM ¹ Saâdia NASSIK ¹ Thomas BALENGHIEN ² Abderrahmane ZAHRI ¹ Salma BOUZIANE ¹ M'hammed SARIH ³ Maria BOURQUIA ¹	¹ Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, Morocco ² CIRAD, UMR ASTRE, F- 34398- Montpellier University, Montpellier, France ³ Institut Pasteur du Maroc, Casablanca, Morocco	[COT3-12] First Microscopic Evidence of Avian Haemosporidian Infections in Domestic Hens (<i>Gallus gallus domesticus</i>) in Morocco: A Preliminary Survey in the Rabat-Salé-Kénitra Region
Ayoub KALALIOS ^{1,2} Mouad BAALOUACHE ¹ Salma BOUZIANE ¹ Mehdi AHLAMINE ² Abderrahmane ZAHRI ¹ Maria BOURQUIA ¹	¹ Hassan II Agronomic and Veterinary Institute, Rabat, Morocco ² Municipal Veterinary Service, Municipality of Marrakech, Morocco	[COT3-13] Epidemiological Study of Filarial Infections in Dogs from Marrakech Province, Morocco



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WORKSHOPS PROGRAM

WORKSHOPS SESSIONS

Workshop Facilitator	Organization	Theme	Workshop Title	Date/ Time
Pr. Feten FEKIH-ROMDHANE & Pr. Souheil HALLIT	Fac de Médecine, Tunisia USEK, Lebanon	T1-6 [WT1-1]	Addiction aux écrans, mythe ou réalité ? Comprendre pour mieux prévenir. (USEK, Lebanon)	June 30 2026 16h30 - 18h00
Pr. Imane TAOUFIQ & Pr. Btissame ZARROUQ	Univ Hassan II-Casablanca ENS-Fès	T1-8 [WT1-2]	L'entretien motivationnel : outils et applications thérapeutiques	July 1 2026 10h30 - 12h00
Dr. Inge HUYBRECHTS	CIRC/OMS, Lyon-France	T2-6 [WT2-1]	Sustainable lifestyle and health in the Age of Artificial Intelligence	June 30 2026 16h30 - 18h00
Dr. Farida Selmouni	CIRC/OMS, Lyon-France	T2-8 [WT2-2]	L'épidémiologie du cancer et la recherche interventionnelle appliquées au cancer du col de l'utérus	July 1 2026 10h30 - 12h00
Pr. Souad GUERNAOUI	FSDM, Fez-Morocco	T3-6 [WT3-1]	Entomologie et Malacologie médicales	June 30 2026 16h30 - 18h00
Dr. Denis SERENO, Pr. Maria BOURQUIA & Pr. Souad GUERNAOUI	IRD, Montpellier-France IAV HII Morocco FSDM, Fez-Morocco	T3-8 [WT3-2]	Utilisation de l'Intelligence Artificielle pour l'Identification des Moustiques au Maroc.	July 1 2026 10h30 - 12h00



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THEME 1 : EPIDEMIOLOGY OF ADDICTION

[COT1-1] Epidemiological profile of cannabis addiction among young people in Marrakech and its prediction using artificial intelligence techniques

Abdelilah ELHACHIMI

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1. Introduction

Cannabis remains the most widely used illicit substance worldwide, with a growing prevalence among adolescents and young adults. Early cannabis use is associated with cognitive impairment, poor sleep quality, anxiety, depression, academic difficulties, and long-term psychosocial consequences. In Morocco, cannabis consumption constitutes a major public health concern, particularly among young people. Traditional screening approaches, including biological testing and clinical questionnaires, are often costly, invasive, time-consuming, or dependent on specialist interpretation.

Recent advances in Artificial Intelligence (AI) and Machine Learning (ML) have demonstrated promising applications in healthcare, particularly in mental health and addiction research. ML algorithms can identify complex relationships between behavioral, cognitive, and psychological variables, offering new opportunities for early detection and risk prediction. The present research aimed to investigate the epidemiological profile of cannabis addiction among Moroccan youth and evaluate the effectiveness of ML techniques for addiction screening and prediction.

2. Materials and Methods

This study was conducted in the Marrakech-Safi region of Morocco between 2019 and 2025 and aimed to investigate the epidemiological profile of cannabis addiction among young people while evaluating the potential of artificial intelligence for addiction screening and prediction. Two independent cross-sectional datasets were collected. The first dataset included 146 participants, consisting of 73 cannabis-addicted individuals and 73 non-addicted controls. The second dataset comprised 200 participants, including 103 addicted and 97 non-addicted individuals. Participants were recruited from addiction treatment and prevention settings and were assessed using a standardized data collection protocol.

Data collection included sociodemographic and socioeconomic characteristics, as well as several validated clinical and psychometric instruments. Cognitive performance was assessed using the Montreal Cognitive Assessment (MoCA), sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI), and symptoms of anxiety and depression were measured using the Hospital Anxiety and Depression Scale (HADS). Cannabis addiction status was established according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), through the assessment of Cannabis Use Disorder (CUD) criteria.

The collected data were analyzed using both conventional statistical approaches and machine learning techniques. Descriptive and comparative analyses were performed to identify differences between addicted and non-addicted participants regarding cognitive performance, sleep quality, and psychological characteristics. Subsequently, several supervised machine learning algorithms were developed and evaluated for cannabis addiction screening and prediction, including Logistic Regression, Support Vector Machine (SVM), K-Nearest Neighbors (KNN), Decision Tree (DT), Artificial Neural Networks (ANN), Multilayer Perceptron (MLP), and Extreme Gradient Boosting (XGBoost).

Model performance was assessed using a training-test framework combined with five-fold cross-validation. The predictive ability of each model was evaluated through multiple performance metrics, including accuracy, sensitivity, specificity, Receiver Operating Characteristic (ROC) curves, and the Area Under the Curve (AUC). These procedures

were implemented to identify the most reliable and clinically useful machine learning model for the detection and prediction of cannabis addiction among Moroccan youth.

3. Results

The comparative analysis revealed marked differences between cannabis-addicted and non-addicted participants. Individuals with cannabis addiction exhibited significantly lower cognitive performance, as reflected by reduced Montreal Cognitive Assessment (MoCA) scores, and poorer sleep quality, as measured by the Pittsburgh Sleep Quality Index (PSQI). In addition, cannabis addiction was strongly associated with depressive symptoms and with the comorbidity of anxiety and depression. Conversely, anxiety alone was not significantly associated with addiction status. These findings indicate that cannabis addiction among young people is accompanied by substantial cognitive, psychological, and sleep-related impairments.

The machine learning analyses demonstrated a high capacity for accurately identifying cannabis-addicted individuals. In the first dataset, which incorporated cognitive and psychological variables, the Support Vector Machine (SVM) model achieved the best classification performance, with an accuracy of 96.6%, a sensitivity of 100%, and a specificity of 93%. These results clearly outperformed the DSM-5 Cannabis Use Disorder (CUD) clinical screening approach, which achieved an accuracy of 87.7%, a sensitivity of 75%, and a specificity of 100%. The superior performance of the SVM model suggests that machine learning algorithms can effectively capture complex relationships between cognitive functioning, psychological distress, and addiction status.

In the second dataset, predictive models were developed using cognitive performance and sleep quality indicators. The Extreme Gradient Boosting (XGBoost) algorithm achieved an accuracy of 90%, a sensitivity of 81%, and a specificity of 100%, while the Multilayer Perceptron (MLP) model obtained an accuracy of 92.5%, a sensitivity of 86%, and a specificity of 100%. These findings confirmed the reliability and robustness of machine learning approaches for addiction prediction using non-invasive clinical and behavioral assessments. Overall, the developed models demonstrated excellent discriminative ability and highlighted the relevance of cognitive and sleep-related variables as key predictors of cannabis addiction among Moroccan youth.

4. Discussion

The findings indicate that cannabis addiction is associated with impaired cognitive performance, poorer sleep quality, and increased depressive symptoms among young people. Machine learning models, particularly SVM, XGBoost, and MLP, demonstrated excellent performance in detecting cannabis addiction and outperformed conventional clinical screening methods. These results suggest that artificial intelligence can effectively identify complex relationships between cognitive, psychological, and behavioral factors linked to addiction. Given its non-invasive, cost-effective, and scalable nature, AI-based screening may represent a valuable tool for early detection and prevention of cannabis addiction, particularly in resource-limited settings such as Morocco.

5. Conclusion

Cannabis addiction among young people was associated with cognitive impairment, poor sleep quality, and increased psychological distress. Machine learning models, particularly SVM, XGBoost, and MLP, demonstrated excellent performance in identifying and predicting cannabis addiction, outperforming or complementing conventional screening methods. These findings highlight the potential of artificial intelligence as a reliable, non-invasive, and cost-effective tool for early addiction detection and prevention. Its implementation could support healthcare professionals in improving preventive interventions and reducing the burden of cannabis addiction among Moroccan youth. Further studies are needed to validate these models in larger populations and enhance their clinical applicability.



[COT1-3] From denial to awareness: exploring the shift from precontemplation to contemplation of cannabis use disorder in young people with ADHD

Anass HAIMOUNI

Sidi Mohamed Ben Abdellah University - ENS – Fez, Morocco

1. Introduction

Peoples with Attention Deficit/Hyperactivity Disorder (ADHD) are more likely to use psychoactive substances than the general population . Among the most commonly used substances, cannabis plays a significant role. Although some individuals report using it to cope with the daily difficulties associated with ADHD, this use can develop into a Cannabis Use Disorder requiring specialized care. However, despite the negative consequences associated with this consumption, many users do not immediately recognize its problematic nature and remain in the precontemplation stage. The transition to the contemplation stage, characterized by the emergence of an awareness of the problem, constitutes an essential step in the support process. In this context, numerous studies focused on addictive mechanisms, risk factors, the consequences of cannabis use and effectiveness of therapies. However, the factors that promote awareness of this problematic use remain less explored. Understanding the elements that promote this awareness is therefore an essential lever for strengthening the relevance of psychoeducational and therapeutic actions, thus facilitating the engagement of subjects in the change process. In light of these findings, the objective of this research is to identify the elements that promote the transition from precontemplation to contemplation of Cannabis Use Disorder among young people with ADHD.

2. Materials and Methods

To determine the elements that promote the transition from precontemplation to contemplation of Cannabis Use Disorder among young people with ADHD, we conducted a qualitative study with ten young people aged twenty to thirty, diagnosed with Cannabis Use Disorder comorbid with ADHD. Participants were selected directly after an assessment of their motivation level by URICA Scale. Data collection was carried out in a semi-structed interview, developed in line with the research theme. The interview was conducted individually and live with each participant, lasting an average of thirty minutes, during which they freely develop their answers on the elements that promote their transition from precontemplation to contemplation of Cannabis Use Disorder. With the participants' prior consent, the interviews were recorded using an audio device. The recordings were then transcribed using Otter.ai software. However, careful review was performed to correct any transcription errors and ensure the accuracy of the verbatim transcripts. The data analysis was conducted according to the thematic approach proposed by Braun and Clarke (2006), which is based on a rigorous systematic process to identify, analyze and interpret themes from qualitative data.

3. Results

Our semi-structured interviews revealed a set of elements promoting the transition from precontemplation to contemplation of Cannabis Use Disorder among young people with ADHD, grouped as follows:

The presentation: This element encompasses physical, clothing and hygiene aspects. Subjects report changes in skin tone, weight loss, poor personal hygiene and neglected clothing. Awareness of the deterioration in their overall appearance caused by cannabis use related behaviors made them conscious of this disorder.

Psychiatric aspects: Participants reported experiencing psychotic episodes induced by cannabis use, which they described as terrifying. These experiences and fear of decompensation led these young people to recognize the harmful effects of cannabis on their mental health, contributing to their awareness of this disorder.

Psychosocial aspects: Bad company, perceived stigmatization and social rejection contributed to the individuals' awareness of Cannabis Use Disorder.

Legal aspects: Here, arrests and incarcerations represent important factors in the raise of awareness. Indeed, the atrocious moments that the subjects report experiencing during these events, as well as the consequences of these events on their social and professional lives, have led to an awareness of Cannabis Use Disorder.

Future concerns: Psychoeducational interventions and exposure to the tragic trajectories of older people with Cannabis User Disorder during psychoeducational workshops contributed to this awareness by raising participants' concerns about their future.

4. Analysis:

For our participants, cannabis use was initially a way to cope with difficulties in their daily life. Gradually, this use became a source of suffering without them immediately realizing this shift. In fact, many people use psychoactive substances for the well-being they provide; however, this use can quickly evolve into a Substance Use Disorder, without these individuals perceiving their use as problematic (Broome et al., 1997). For our participants, the realization of their Cannabis Use Disorder was the root cause of the detrimental effects of this use on their self-presentation, mental health, social and professional life. Similarly, the systematic review by Raftery et al. (2020) reveals that a better awareness is generally linked to the perception of the negative consequences of substance use. Furthermore, access to addiction education and exposure to the hardships experienced by peers with Substance Use Disorders encourage participants to become aware of their own cannabis use behaviors by worrying about their future consequences. As a matter of fact, the worry about the current behavioral pattern is the key element for the transition to contemplation in a precontemplative user.

5. Conclusion:

This research has allowed us to identify the elements that promote the transition from precontemplation to contemplation of Cannabis use Disorder in young people with ADHD. Indeed, awareness of the decline in overall presentation, mental health, social and professional life mediates this transition, as do worries about future consequences of cannabis use. This transition occupies a fundamental place in the process of change. Future research on the coping mechanisms these contemplative young people use to deal with their Cannabis Use Disorder will build upon our current research, all aimed at a comprehensive understanding of the change process in young people with Cannabis Use Disorder comorbid with ADHD in order to improve their support.

References

Raftery, D., Kelly , P. J., Deane, F. P., Amanda, A. L., Ingram, I., Goh, M. C., . . . McKetin, R. (2020). insight in Substance Use Disorder: A Systematic Review of the Literature. Addictive Behaviors.

DiClemente, C. C. (2018). How AddictionsDevelop and Addicted People Recover. New York: Guilford Press.

Broome, K. M., Knight, D. K., Knight, K., Hiller, M. L., & Simpson, D. D. (1997). Peer, Family, and motivational influences on drug treatment process and recidivisme for probationers. Journal of Clinical Psychology , 53(4), 387-97.

Braun, V., & Clarke, V. (2006). Using Thematic Analysis in Psychology. Qualitative Research in Psychology, 3(2), 77–101.

Brown, T. E. (2013). A New Understanding of ADHD in Children and Adults: Executive Function Impairments. New York: Routledge.

[COT1-4] Tobacco Advertising Exposure and Adolescent Tobacco Use in Morocco: A Latent Class Analysis

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1. Introduction

Tobacco use is a major preventable public health problem and remains particularly concerning in low- and middle-income countries 1–3. Adolescence is a vulnerable period because tobacco experimentation often begins early and may lead to nicotine dependence and continued use in adulthood 3–8. Tobacco marketing can increase product appeal by associating tobacco with social approval, autonomy, peer bonding, and attractive lifestyles 3,7–11. Moroccan adolescents may encounter tobacco promotion through several channels, including media depictions, point-of-sale promotions, tobacco-branded items, and direct promotional offers 12.

Previous studies often measured each advertising channel separately. However, exposure in real life is multidimensional, and adolescents may experience combinations of several marketing channels. Latent Class Analysis (LCA) allows the identification of hidden subgroups with similar exposure profiles 13–16. This study aimed to identify latent classes of exposure to tobacco product advertisements among Moroccan adolescents and to examine their association with current tobacco product use.

2. Materials and Methods

We used data from the 2016 Morocco Global Youth Tobacco Survey (GYTS), a nationally representative school-based survey conducted within the Global Tobacco Surveillance System. The GYTS uses a standardized methodology to monitor tobacco use and tobacco-control indicators among students. From 3,915 participants initially enrolled, 3,614 adolescents with complete data on the selected exposure indicators were included in the analysis 12.

Five indicators were used to define exposure profiles: seeing people using tobacco on television, videos, or movies; seeing tobacco advertisements or promotions at points of sale; willingness to use or wear an item with a tobacco company or product name or picture; ownership of an item with a tobacco brand logo; and ever being offered a free tobacco product by a person working for a tobacco company. Sociodemographic variables included sex, age, area of residence, parental employment, parental education, and weekly spending money. Outcomes were current cigarette use, current use of smoked tobacco products other than cigarettes, and current smokeless tobacco use during the past 30 days.

LCA models with two to seven classes were compared. The optimal model was selected using the Akaike Information Criterion, Bayesian Information Criterion, Consistent Akaike Information Criterion, entropy, and likelihood-ratio statistics. Chi-square tests examined differences across latent classes 14–16. Binary logistic regression models estimated adjusted odds ratios for associations between class membership and tobacco use.

3. Results

The sample was nearly balanced by sex, with 51.18% girls and 48.82% boys, and was predominantly urban (82.16%). Adolescents aged 14–15 years represented 47.96% of participants, while 38.95% were aged 13 years or younger. Current tobacco use was reported by 2.21% for cigarettes, 2.62% for smoked tobacco products other than cigarettes, and 3.00% for smokeless tobacco products.

The three-class solution provided the best balance between model fit and interpretability. Class 1, labelled “media exposure,” represented 24.71% of adolescents and was characterized mainly by exposure through television, videos, or movies, with very low exposure to other marketing channels. Class 2, labelled “media and point-of-sale exposure,” represented 66.60% of the sample and combined media exposure with high exposure at points of sale, but low engagement with branded items or direct promotional offers. Class 3, labelled “multimodal exposure,” represented 8.69% of adolescents and showed the highest exposure across several channels, including media, points of sale, branded items, ownership of branded objects, and offers from tobacco-company workers.

Latent classes differed significantly according to sociodemographic characteristics and tobacco use. The multimodal exposure class included a higher proportion of boys and older adolescents and had the highest prevalence of current cigarette use, other smoked tobacco use, and smokeless tobacco use. In adjusted models, compared with the media exposure class, multimodal exposure was significantly associated with cigarette use (AOR = 4.41; 95% CI: 2.20-8.80; $p \leq 0.001$), use of smoked tobacco products other than cigarettes (AOR = 2.33; 95% CI: 1.20-4.53; $p \leq 0.01$), and smokeless tobacco use (AOR = 2.27; 95% CI: 1.21-4.26; $p \leq 0.01$).

4. Discussion

The findings suggest that combined exposure to multiple forms of tobacco marketing is strongly associated to adolescent tobacco use. Adolescents in the multimodal exposure class were not only exposed through common media channels but also through more engaging forms of marketing such as branded items and direct promotional contact. These channels may reinforce positive perceptions of tobacco, normalize use, and increase product appeal among young people.

These results are relevant for tobacco-control policy in Morocco. Although national legislation restricts tobacco advertising and promotion, the existence of a multimodal exposure group indicates that adolescents may still be reached through direct and indirect promotional practices. Stronger enforcement of advertising bans, regular monitoring of points of sale, restriction of tobacco-branded items, and attention to indirect forms of marketing are needed. Prevention programs should also strengthen media literacy, refusal skills, and resistance to peer influence. The main limitations are the cross-sectional design, which prevents causal inference, and the use of self-reported data. Nevertheless, the study benefits from a nationally representative dataset and an analytical approach that captures complex exposure profiles.

5. Conclusion

Three distinct exposure profiles were identified among Moroccan adolescents: media exposure, media and point-of-sale exposure, and multimodal exposure. The multimodal exposure class, although the smallest group, was consistently associated with higher odds of using cigarettes, other smoked tobacco products, and smokeless tobacco products. These findings support comprehensive enforcement of tobacco advertising bans and integrated prevention strategies that address multiple marketing channels simultaneously.

Keywords: Adolescents; Advertisements; Global Youth Tobacco Survey; Latent Class Analysis; Morocco; Tobacco use.

References

1. The WHO. Tobacco. Accessed July 12, 2024. <https://www.who.int/news-room/fact-sheets/detail/tobacco>
2. More than 100 reasons to quit tobacco - PAHO/WHO | Pan American Health Organization. Accessed July 12, 2024. <https://www.paho.org/en/more-100-reasons-quit-tobacco>
3. Thomas D. L'enfant et l'adolescent, cibles de l'industrie du tabac. Bull Académie Natl Médecine. 2019;203(7):541-548.
4. Adolescent and young adult health. Accessed August 10, 2023. <https://www.who.int/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions>
5. Health UD of, Services H. Preventing tobacco use among youth and young adults: a report of the Surgeon General. Published online 2012.
6. Robert J W, David B S, Joseph R D, Jonathan P W. The extent to which tobacco marketing and tobacco use in films contribute to children's use of tobacco: a meta-analysis. Arch Pediatr Adolesc Med. 2006;160(12). doi:10.1001/archpedi.160.12.1285

7. Lovato C, Watts A, Stead LF. Impact of tobacco advertising and promotion on increasing adolescent smoking behaviours. *Cochrane Database Syst Rev*. 2011;2011(10):CD003439. doi:10.1002/14651858.CD003439.pub2
8. DeBry SC, Tiffany ST. Tobacco-induced neurotoxicity of adolescent cognitive development (TINACD): a proposed model for the development of impulsivity in nicotine dependence. *Nicotine Tob Res*. 2008;10(1):11-25.
9. Tobacco: Industry tactics to attract younger generations. Accessed July 13, 2024. <https://www.who.int/news-room/questions-and-answers/item/tobacco-industry-tactics-to-attract-younger-generations>
10. Pierce JP. Tobacco industry marketing, population-based tobacco control, and smoking behavior. *Am J Prev Med*. 2007;33(6):S327-S334.
11. CDCTobaccoFree. Tobacco Industry Marketing. Centers for Disease Control and Prevention. October 20, 2023. Accessed July 8, 2024. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/tobacco_industry/marketing/index.htm
12. World Health Organization (WHO). Morocco - Global Youth Tobacco Survey 2016. Accessed February 16, 2025. <https://extranet.who.int/ncdsmicrodata/index.php/catalog/314/study-description>
13. Tripathy JP, Lakshmi PVM. Patterns of exposure to smoked tobacco advertisements among youths in India and its association with smoked tobacco use: a Latent Class Analysis. *Public Health*. 2023;223:156-161.
14. Weller BE, Bowen NK, Faubert SJ. Latent Class Analysis: A Guide to Best Practice. *J Black Psychol*. 2020;46(4):287-311. doi:10.1177/0095798420930932
15. Karnowski V. Latent Class Analysis. *The International Encyclopedia of Communication Research Methods*. <https://doi.org/10.1002/9781118901731.iecrm0130>
16. Collins LM, Lanza ST. Latent Class and Latent Transition Analysis: With Applications in the Social, Behavioral, and Health Sciences. Vol 718. John Wiley & Sons; 2009.

[COT1-5] Factors associated with the failure of smoking cessation attempts in Oujda

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1. Introduction

Smoking is one of the leading preventable causes of illness and death worldwide, and a major risk factor for cardiovascular, respiratory and cancerous diseases. Despite widespread awareness of its harmful effects, smoking persists. Nevertheless, the desire to quit is widespread: almost 60% of smokers report wanting to stop (1). However, quitting smoking is a complex process, often involving several attempts before achieving permanent cessation. Relapses and failures are an integral part of this journey. Therefore, a failed quit attempt does not simply reflect a lack of success, but is part of a complex process influenced by biological, psychological and social factors that determine the outcome of quitting attempts. At the local level, data concerning this phenomenon remain limited. The aim of our study is to explore the factors associated with failed smoking cessation attempts in Oujda.

2. Materials and Methods

This descriptive, analytical, cross-sectional, exploratory, observational study was conducted among abstinent and current smokers who had previously attempted to quit. The study was carried out in Oujda over a period of six months. Data were collected using a structured questionnaire. Nicotine dependence was assessed using the Fagerström Test. A failed attempt to quit was defined as relapse after at least seven days of abstinence, in accordance with methodological recommendations for tobacco cessation (2). Statistical analysis was performed using SPSS software.

3. Results

A total of 131 participants were included in the study. The mean age was $35.2 \pm 12,7$ years. The population was predominantly male, with 98.7% of participants being male. The mean age at which smoking was initiated was 17.8 ± 2.9 years, and the mean duration of smoking was 16.4 ± 12.4 years. The mean nicotine dependence score, as determined by the Fagerström Test, was 4.9 ± 2.3 , indicating moderate overall dependence. Of the 131 participants, 74% reported having made a failed attempt to quit smoking.

Bivariate analysis of factors associated with failed quit attempts revealed several statistically significant variables.

Younger participants experienced more failed quit attempts than older participants ($p = 0.004$). Being single was also associated with a higher probability of failure ($p < 0.001$).

Regarding medical and psychological factors, a history of mental health disorders was significantly associated with failure ($p = 0.036$).

Among the behaviours studied, alcohol consumption was strongly associated with failed smoking cessation attempts ($p < 0.001$), while a lack of physical activity also increased the probability of failure ($p = 0.002$).

The social environment appeared to be a major determinant. The presence of smokers in one's social circle was strongly associated with failed cessation attempts ($p < 0.001$). Similarly, a lack of social support was significantly associated with a higher probability of relapse ($p < 0.001$).

From a therapeutic standpoint, the failure to quit was associated with the absence of smoking cessation aids ($p = 0.020$). However, no statistically significant association was observed between the level of nicotine dependence, as assessed by the Fagerström test, and failure to quit ($p = 0.46$).

Furthermore, several withdrawal symptoms were significantly associated with failure, including weight gain ($p = 0.012$), sleep disturbances ($p = 0.038$) and excessive fatigue ($p = 0.026$).

4. Discussion

Our study examined the factors associated with failed attempts to quit smoking in Oujda. The high failure rate observed (74%) confirms the difficulty of quitting smoking and highlights the iterative and complex nature of this process.

The results highlight the predominance of psychosocial, behavioural and environmental factors in cessation attempt failure. Significant factors include young age, single status, lack of social support, and risky behaviours such as alcohol consumption and a sedentary lifestyle. Furthermore, the influence of the smoking environment, particularly the presence of smoking friends, exposure to second-hand smoke and easy access to cigarettes, seems to play a central role, suggesting that contextual factors significantly affect the maintenance of smoking behaviour.

Conversely, nicotine dependence, as measured by the Fagerström Test, was not significantly associated with cessation failure. This lack of association suggests that social and environmental factors may have a more significant influence than nicotine addiction alone in our sample. However, it may also reflect the limitations inherent in the exploratory nature of the study and the size of our sample.

These results are consistent with previous research, which emphasises the importance of psychosocial and environmental factors in the success or failure of smoking cessation attempts, as well as nicotine addiction.

5. Conclusion

Failure to quit smoking remains common in the studied population and appears to be primarily associated with psychosocial and environmental factors. These results emphasise the importance of taking a comprehensive approach to smoking cessation that considers social and behavioural factors alongside nicotine dependence. Further research is required to confirm these associations and inform intervention strategies.

6. References:

1. Hughes JR, Carpenter MJ, Naud S. Do point prevalence and prolonged abstinence measures produce similar results in smoking cessation studies? A systematic review. *Nicotine Tob Res.* juill 2010;12(7):756-62. doi:10.1093/ntr/ntq078 PubMed PMID: 20504946; PubMed Central PMCID: PMC2893294.
2. Hughes JR, Keely JP, Niaura RS, Ossip-Klein DJ, Richmond RL, Swan GE. Measures of abstinence in clinical trials: issues and recommendations. *Nicotine Tob Res.* 2003;5(1):13-25. doi:10.1080/1462220031000070552.

[COT1-7] Motives for alcohol use among university students in the Middle East and North Africa region: Insights from a Systematic Review

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1. Introduction

University student alcohol use constitutes a pressing global public health challenge. Across the Middle East and North Africa (MENA), the issue is particularly intricate, as deeply rooted cultural, religious, and social codes may simultaneously shape consumption behaviors and inhibit their open reporting. While prevalence figures have drawn considerable research interest, the underlying reasons that drive students to drink remain markedly underexplored in this setting. This component of the systematic review was designed to consolidate the available evidence on drinking motives among university students within MENA countries.

2. Materials and Methods

The review was conducted and reported in accordance with the PRISMA guidelines. Its protocol was prospectively registered with PROSPERO (CRD42024576398). A systematic search of five electronic databases—Web of Science, PubMed, Scopus, the Cochrane Library, and the Directory of Open Access Journals (DOAJ)—was performed up to 26 September 2025, with no restriction placed on the earliest publication date. To capture grey literature and further pertinent records, complementary searches were executed through Google Scholar, SciSpace, Elicit, manual screening of reference lists, and targeted browsing of the World Health Organization website. The methodological quality of the included studies was assessed using the JBI Critical Appraisal Checklist for Studies Reporting Prevalence Data.

3. Results

The search strategy retrieved 1,266 records, from which 44 studies were retained. Data collection periods spanned 2004 to 2024 across ten MENA nations, and the methodological quality of the included studies was generally strong. Five principal categories of drinking motives emerged.

Social and recreational factors ranked among the most frequently reported. In Morocco, 24.5% [1] of students attributed their first alcohol intake to being with friends, while in Lebanon and Tunisia consumption was closely tied to celebratory events and social outings. [2], [3].

Emotional regulation and coping represented another salient cluster. In Tunisia, 65.5% [4] of drinkers stated they consumed alcohol to relax or to feel better, and 36.6% [5] of Palestinian students reported turning to alcohol to flee from problems.

Curiosity, pleasure, and sensation seeking were heavily implicated in initiation. Curiosity accounted for initial use in 46.4% [6] of Iranian students and 46.2% [1] of their Moroccan counterparts.

Situational and access-related facilitators also played a role. Ease of access was cited as a decisive factor by 60.4% [5] of students in Palestine, whereas in Iraq the presence of drinking peers or family members created a permissive atmosphere [50].

Habit and dependence motives were documented less extensively. Continued drinking was ascribed to addiction by 14.9% [1] of current consumers in Morocco and 25.1% [5] in Palestine; in Iran, 6.7% described their ongoing use as an addictive routine [6].

4. Discussion

These findings illuminate that alcohol use among MENA university students is governed not by a single explanation but by a constellation of interlocking motives. Social drivers—peer influence, friendship networks, communal celebrations, and the texture of campus life—occupy a central explanatory role. Crucially, within the MENA context such motives must be read against a backdrop where alcohol use can be forbidden, heavily stigmatized, or kept deliberately hidden, profoundly coloring both the experience and the articulation of these reasons.

5. Conclusion

Grasping the why behind student drinking is just as vital as quantifying how many drink. The evidence calls for the deployment of targeted, confidential, and culturally grounded prevention strategies on university campuses—strategies that weave together awareness efforts, mental health support, stress management programming, peer influence literacy, and early detection of hazardous patterns.

Keywords: alcohol consumption; university students; Middle East and North Africa; drinking motives; systematic review; prevention.

References

[1] A. Baslam, H. Kabdy, A. Ait Baba, R. Aboufatima, S. Boussaa, et C. Abderrahman, « Substance use among university students and affecting factors in Central Morocco: a cross-sectional Study », Academic Journal of Medicine & Health Sciences, vol. 38, p. 146-153, mai 2023, doi: 10.3306/AJHS.2023.38.05.146.

[2] N. Richa, A. Ghosn, et S. Richa, « Facteurs de protection dans les conduites d'alcoolisation chez les étudiants de l'université Saint-Esprit de Kaslik au Liban. Étude transversale effectuée sur des étudiants séminaristes et non séminaristes », Annales Médico-psychologiques, revue psychiatrique, vol. 170, no 8, p. 533-540, oct. 2012, doi: 10.1016/j.amp.2012.02.002.

[3] C. Zedini et al., « Prévalence et facteurs associés à la consommation d'alcool chez les étudiants de Sousse, Tunisie », Santé Publique, vol. 29, no 2, p. 255-262, 2017, doi: 10.3917/spub.172.0255.

[4] A. Ben Abdelaziz et al., « Alcohol consumption among health sciences students at the University of Monastir (Tunisia, 2014) », Tunis Med, vol. 96, no 10-11, p. 571-583, 2018.

[5] B. Damiri, H. N. Sandouka, E. H. Janini, et O. N. Yaish, « Prevalence and associated factors of psychoactive substance use among university students in the West Bank, Palestine », Drug-Educ. Prev. Policy, vol. 27, no 2, p. 173-182, mars 2020, doi: 10.1080/09687637.2019.1591341.

[6] S. T. Heydari et al., « The Prevalence of Substance use and Associated Risk Factors Among University Students in the City of Jahrom, Southern Iran », Int J High Risk Behav Addict, vol. 4, no 2, p. e22381, juin 2015, doi: 10.5812/ijhrba.4(2)2015.22381.

[7] Sarah Kadhim Abbood, Ali Mohammed Abd Alridha, Karrar Mohammed Al-Gburi, Noorulhuda Ali Mohsin, Afnan Saud Ismael, et Ahmed Basim Ali, Ali Talib Salih, « Prevalence and Epidemiological Characteristics Associated with Hookah Smoking and Alcohol Consumption among Medical Students in Najaf, Iraq », [En ligne]. Disponible sur: file:///C:/Users/kenza/OneDrive/Bureau/prevalence_and_epidemiological_characteristics.26.pdf



[COT1-8] Gut Microbiota and Addiction: Toward a New Understanding of the Gut–Brain Axis

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1. Introduction

Addiction is a major global public health challenge. According to international estimates, more than 280 million people use illicit psychoactive substances, with prevalence steadily increasing over recent decades. Substance use disorders are associated with substantial morbidity, considerable socioeconomic costs, and high relapse rates despite currently available therapeutic interventions [1].

Traditionally, the neurobiology of addiction has been attributed to dysregulation of the brain reward circuitry, particularly the mesolimbic dopaminergic pathway. However, recent advances in neuroscience and microbiology have led to the emergence of a new paradigm highlighting the role of the gut microbiota in regulating behavior, mood, and susceptibility to addiction [2].

The gut microbiota comprises thousands of microbial species living in symbiosis with the host. Beyond its digestive and metabolic functions, it actively contributes to bidirectional communication between the gastrointestinal tract and the central nervous system through the microbiota–gut–brain axis. This complex network involves neural, endocrine, immune, and metabolic pathways that influence brain function and behavior [2,3].

Growing evidence indicates that psychoactive substances alter gut microbial composition, leading to dysbiosis that may exacerbate behavioral disturbances, anxiety, depression, and addictive behaviors. Conversely, alterations in gut microbial communities may also influence individual vulnerability to substance dependence [4].

The hypothesis that the gut microbiota directly modulates addiction susceptibility, withdrawal severity, and drug-seeking behavior has attracted increasing scientific interest. The present work aims to review current evidence from the literature and recent preclinical models to elucidate how microbial alterations shape addictive behaviors and to discuss emerging therapeutic strategies targeting the gut–brain axis.

2. Materials and Methods

A systematic literature review was conducted using the major scientific databases (PubMed, Scopus, and Google Scholar) covering publications from 2010 to 2025. Search strategies combined standardized Medical Subject Headings (MeSH) including gut microbiota, substance use disorders, gut–brain axis, addiction vulnerability, and dysbiosis, together with specific substances such as cocaine, methamphetamine, alcohol, and MDMA.

Eligible studies included clinical observational investigations in humans and mechanistic experimental studies in rodent models evaluating microbial alpha and beta diversity as well as changes in bacterial abundance following xenobiotic exposure.

To illustrate biological causality, data from an experimental study investigating 3,4-methylenedioxymethamphetamine (MDMA, Ecstasy) dependence in Wistar rats were included. The experimental protocol comprised:

Behavioral validation of addiction using the Conditioned Place Preference (CPP) paradigm over 30 days, together with anxiety- and depression-related behavioral tests including the Elevated Plus Maze (EPM), Open Field Test (OFT), and Forced Swim Test (FST) to characterize withdrawal syndrome.

High-resolution microbiological profiling through identification and quantification of intestinal bacterial communities from fecal samples using Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF MS) [5].



3. Results

Addiction-induced gut dysbiosis

Accumulating evidence demonstrates that chronic exposure to psychoactive substances is consistently associated with significant alterations in gut microbial composition.

Studies involving users of cocaine, methamphetamine, alcohol, nicotine, and opioids report a marked reduction in bacterial diversity accompanied by an increase in potentially pathogenic bacteria and a depletion of beneficial microbial taxa [6]. This dysbiosis promotes increased intestinal permeability, facilitating the systemic translocation of pro-inflammatory molecules and contributing to neuroinflammatory processes.

In experimental MDMA models, chronic exposure induced a pronounced decline in both bacterial density and overall microbial diversity compared with control animals. At the taxonomic level, dependent animals exhibited profound depletion of beneficial and protective bacterial genera.

Systemically, addiction and withdrawal were associated with marked activation of stress-response pathways. Plasma cortisol concentrations were significantly elevated in dependent animals and positively correlated with behavioral despair, reflected by increased immobility time in the Forced Swim Test, and severe anxiety-like behavior, evidenced by a substantial reduction in time spent in the open arms of the Elevated Plus Maze.

4. Discussion

The relationship between the gut microbiota and addictive behaviors involves multiple interconnected pathophysiological pathways that redefine our understanding of neurobiological vulnerability.

The gut microbiota is now recognized as a highly active biochemical organ capable of producing neurotransmitters identical to those found in the central nervous system. More than 50% of circulating dopamine and the majority of peripheral serotonin originate within the gastrointestinal tract.

Chronic exposure to addictive substances disrupts intestinal epithelial tight junctions, resulting in increased intestinal permeability ("leaky gut"). This process enables bacterial products, particularly lipopolysaccharides (LPS), to enter the systemic circulation. By activating Toll-like receptor 4 (TLR4), LPS initiates a pro-inflammatory cytokine cascade capable of affecting the blood–brain barrier. Within the brain, neuroinflammation activates microglia, impairs synaptic plasticity, and perpetuates dysfunction of reward-related neural circuits.

Microbial metabolites, particularly short-chain fatty acids (SCFAs), regulate the expression of brain-derived neurotrophic factor (BDNF) and modulate hypothalamic–pituitary–adrenal (HPA) axis responsiveness. Psychobiotic bacteria, including *Lactobacillus* species, directly communicate with the brain through the vagus nerve, attenuating anxiety-like behaviors and compulsive drug-seeking. Emerging evidence also suggests that plant-derived phytopsychotherapeutics, such as *Anacyclus pyrethrum* extract, may exert dual effects by suppressing pathogenic bacteria while promoting the growth of beneficial microbial communities.

5. Conclusion

Recognition of the microbiota–gut–brain axis is fundamentally reshaping our understanding of addiction epidemiology. Rather than being viewed solely as a digestive organ, the gut microbiota should be considered an emerging biomarker of individual susceptibility to substance use disorders.

Routine gut microbiota profiling using technologies such as MALDI-TOF mass spectrometry may, in the future, facilitate the identification of high-risk individuals, improve relapse prediction, and support the development of personalized microbiota-based therapeutic strategies for addiction.

Keywords: Gut microbiota, Addiction, Gut–brain axis, Neurotransmission, Dysbiosis.

References



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- [1] “UNODC World Drug Report 2022 highlights trends on cannabis post-legalization, environmental impacts of illicit drugs, and drug use among women and youth,” United Nations: Office on Drugs and Crime. Accessed: Jun. 25, 2026. [Online]. Available: [//www.unodc.org/unodc/en/frontpage/2022/June/unodc-world-drug-report-2022-highlights-trends-on-cannabis-post-legalization--environmental-impacts-of-illicit-drugs--and-drug-use-among-women-and-youth.html](https://www.unodc.org/unodc/en/frontpage/2022/June/unodc-world-drug-report-2022-highlights-trends-on-cannabis-post-legalization--environmental-impacts-of-illicit-drugs--and-drug-use-among-women-and-youth.html)
- [2] N. D. Volkow and M. Boyle, “Neuroscience of Addiction: Relevance to Prevention and Treatment,” *Am. J. Psychiatry*, vol. 175, no. 8, pp. 729–740, Aug. 2018, doi: 10.1176/appi.ajp.2018.17101174.
- [3] N. I. on D. Abuse, “MDMA (Ecstasy/Molly) | National Institute on Drug Abuse (NIDA).” Accessed: Jun. 25, 2026. [Online]. Available: <https://nida.nih.gov/research-topics/mdma-ecstasy-molly>
- [4] M. McCann, K. Higgins, O. Perra, C. McCartan, and A. McLaughlin, “Adolescent ecstasy use and depression: cause and effect, or two outcomes of home environment?,” *Eur. J. Public Health*, vol. 24, no. 5, pp. 845–850, Oct. 2014, doi: 10.1093/eurpub/cku062.
- [5] A. Baslam et al., “Modulation of Gut Microbiome in Ecstasy/MDMA-Induced Behavioral and Biochemical Impairment in Rats and Potential of Post-Treatment with Anacyclus pyrethrum L. Aqueous Extract to Mitigate Adverse Effects,” *Int. J. Mol. Sci.*, vol. 24, no. 10, p. 9086, Jan. 2023, doi: 10.3390/ijms24109086.
- [6] A. Baslam et al., “Trihexyphenidyl Alters Its Host’s Metabolism, Neurobehavioral Patterns, and Gut Microbiome Feedback Loop—The Modulating Role of Anacyclus pyrethrum,” *Antioxidants*, vol. 13, no. 1, p. 26, Jan. 2024, doi: 10.3390/antiox13010026.



[COT1-10] Cocaine Use Disorder: Working Memory Impairment and Clinical Management

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1. Introduction

In Morocco, the prevalence of cocaine use is estimated at 0.05% in the general population (Ministère de la Santé, 2019). However, the expansion of drug trafficking routes across North Africa has contributed to increased availability of this substance, generating serious public health consequences and a demand for treatment that exceeds the capacity of specialized addiction facilities (United Nations Office on Drugs and Crime [UNODC], 2024; International Narcotics Control Board [INCB], 2023). From a neuropsychological standpoint, Cocaine Use Disorder (CUD) is frequently associated with significant cognitive deficits, particularly in executive functions. Among these, working memory plays a central role in behavioral regulation and decision-making (Verdejo-García et al., 2019). More specifically, visuospatial working memory (VSWM) appears particularly vulnerable in cocaine users, as evidenced by neuroimaging and behavioral studies (Cousijn et al., 2021; Kübler et al., 2005). The present study aims to examine the nature and extent of VSWM impairments in cocaine users through a comparative study using standardized assessment tools, and to discuss the clinical implications of these findings for therapeutic management.

2. Materials and Methods

A comparative study was conducted involving two groups: an experimental group of individuals with a DSM-5 diagnosis of CUD, recruited from the addiction unit of Arrazi Hospital, and a control group matched for age, educational level, and sex, with no history of psychoactive substance use. Visuospatial working memory was assessed using two validated instruments: (a) the Digit Span Test, which evaluates information retention capacity under forward and backward span conditions, the latter placing greater demands on the executive component of working memory (Wechsler, 1997; Zarhouch et al., 2022); and (b) the Corsi Block-Tapping Test, which measures the ability to encode and reproduce sequences of spatial positions, allowing differentiation between the passive storage component and the active manipulation component of VSWM (Facchin et al., 2024). Data were analyzed using comparative statistical methods (Student's t-tests and analyses of variance), controlling for confounding variables including anxiety, depression, and duration of substance use. Ethical considerations were observed, including informed consent and data confidentiality.

3. Results

Comparative analyses revealed significant differences between the CUD group and the control group, modulated by the level of executive load involved in each test condition. Under the forward span condition (low executive load), performance was similar across both groups, with no statistically significant difference, suggesting that passive storage of visuospatial information is not impaired in cocaine users. In contrast, under the backward span condition (high executive load), the CUD group displayed significantly lower performance than the control group on both the Digit Span Test and the Corsi Block-Tapping Test, indicating that active manipulation of information in working memory is the most affected function in cocaine users. These findings are consistent with the longitudinal data reported by Hirsiger et al. (2019) regarding cortical thickness changes associated with cocaine use.

4. Discussion

These results are consistent with the theoretical framework of bidirectional causality between addiction and cognitive deficits (Melugin et al., 2021): cocaine use impairs executive functions, which in turn reduce treatment efficacy and increase relapse risk (Aharonovich et al., 2003). The observed cognitive profile, namely the selective impairment of the functional dimension of VSWM, is supported by neuroimaging evidence of hypoactivation of the dorsolateral prefrontal

cortex during working memory tasks in cocaine users (Cousijn et al., 2021). From a clinical perspective, these data highlight the importance of systematically integrating cognitive assessment into the clinical evaluation of individuals with CUD, as working memory functioning is a significant predictor of treatment retention and abstinence (Aharonovich et al., 2003; Bruijnen et al., 2019). Cognitive remediation programs represent a promising approach to address these deficits. Verdejo-García et al. (2023) underscore the value of targeted cognitive interventions in the treatment of substance use disorders, particularly for improving treatment adherence. In this regard, the Memory-Focused Cognitive Therapy (Marsden et al., 2017) constitutes a promising approach for cocaine users.

5. Conclusion

This study provides empirical evidence on the nature of memory impairments associated with Cocaine Use Disorder. The findings confirm that visuospatial working memory is primarily affected in its functional dimension, while the passive storage component remains relatively preserved. This dissociation has direct implications for cognitive assessment and clinical management in addiction settings. The integration of standardized cognitive assessment tools, such as the Corsi Block-Tapping Test and the Digit Span Test, into addiction treatment protocols would allow clinicians to identify patients at risk of poor treatment adherence and to personalize therapeutic interventions. Cognitive remediation approaches targeting executive functions appear to be an essential complement to conventional treatments, aimed at reducing relapse risk and improving long-term therapeutic outcomes. Longitudinal studies involving larger samples and post-treatment follow-up protocols are needed to confirm these findings and to refine the most effective intervention modalities in the Moroccan context.

References

- Aharonovich, E., Nunes, E., & Hasin, D. (2003). Cognitive impairment, retention and abstinence among cocaine abusers in cognitive-behavioral treatment. *Drug and Alcohol Dependence*, 71(2), 207–211. [https://doi.org/10.1016/s0376-8716\(03\)00092-9](https://doi.org/10.1016/s0376-8716(03)00092-9)
- Bruijnen, C. J. W. H., Dijkstra, B. A. G., Walvoort, S. J. W., Markus, W., VanDerNagel, J. E. L., Kessels, R. P. C., & De Jong, C. A. J. (2019). Prevalence of cognitive impairment in patients with substance use disorder. *Drug and Alcohol Review*, 38(4), 435–442. <https://doi.org/10.1111/dar.12922>
- Cousijn, J., Ridderinkhof, K. R., & Kaag, A. M. (2021). Sex-dependent prefrontal cortex activation in regular cocaine users: A working memory functional magnetic resonance imaging study. *Addiction Biology*, 26(6), e13003. <https://doi.org/10.1111/adb.13003>
- Facchin, A., Pegoraro, S., Castiglieri, G., Daini, R., Rigoli, M., Rizzi, E., Strina, V., Barera, S., & Guarnerio, C. (2024). Regression-based normative data for Corsi span learning and recall in Italian adults. *Neurological Sciences*, 45, 5707–5718. <https://doi.org/10.1007/s10072-024-07644-7>
- Hirsiger, S., Hänggi, J., Germann, J., Vonmoos, M., Preller, K. H., Engeli, E. J. E., Kirschner, M., Reinhard, C., Hulka, L. M., Baumgartner, M. R., Chakravarty, M. M., Seifritz, E., Herdener, M., & Quednow, B. B. (2019). Longitudinal changes in cocaine intake and cognition are linked to cortical thickness adaptations in cocaine users. *NeuroImage: Clinical*, 21, 101652. <https://doi.org/10.1016/j.nicl.2019.101652>
- International Narcotics Control Board. (2023). Annual report 2022 of the International Narcotics Control Board. United Nations. https://www.incb.org/documents/Publications/AnnualReports/AR2022/AR2022_FRE.pdf
- Kübler, A., Murphy, K., & Garavan, H. (2005). Cocaine dependence and attention switching within and between verbal and visuospatial working memory. *European Journal of Neuroscience*, 21(7), 1984–1992. <https://doi.org/10.1111/j.1460-9568.2005.04027.x>
- Marsden, J., Goetz, C., Meynen, T., Mitcheson, L., Stillwell, G., Eastwood, B., Strang, J., & Grey, N. (2017). Memory-focused cognitive therapy for cocaine use disorder: Rationale, design and protocol for an external pilot randomised controlled trial. *Contemporary Clinical Trials Communications*, 8, 264–273. <https://doi.org/10.1016/j.conctc.2017.10.009>



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THE PROCEEDINGS BOOK

Melugin, P. R., Nolan, S. O., & Siciliano, C. A. (2021). Bidirectional causality between addiction and cognitive deficits. *International Review of Neurobiology*, 157, 371–410. <https://doi.org/10.1016/bs.irn.2020.11.001>

Ministère de la Santé. (2019). Enquête nationale sur la prévalence de la consommation des substances psychoactives en population générale au Maroc [National survey on the prevalence of psychoactive substance use in the general population in Morocco]. Direction de l'Épidémiologie et de Lutte contre les Maladies.

United Nations Office on Drugs and Crime. (2024). *World Drug Report 2024*. United Nations.

Verdejo-García, A., García-Fernández, G., & Dom, G. (2019). Cognition and addiction. *Dialogues in Clinical Neuroscience*, 21(3), 281–290. <https://doi.org/10.31887/DCNS.2019.21.3/gdom>

Verdejo-García, A., Rezapour, T., Giddens, E., Khojasteh Zonoozi, A., Rafei, P., Berry, J., & Ekhtiari, H. (2023). Cognitive training and remediation interventions for substance use disorders: A Delphi consensus study. *Addiction*, 118(5), 935–951. <https://doi.org/10.1111/add.16109>

Wechsler, D. (1997). *Wechsler Adult Intelligence Scale* (3rd ed.). Psychological Corporation.

Zarhbouch, B., Safir, A., & Zarhbouch, A. (2022). Adapting Wechsler's digit span test for measuring the working memory capacity to both English and Arabic constraints. *International Journal of Humanities and Educational Research*, 4(3), 265–277.



[COT1-11] Risky Dietary Behaviors and ChatGPT Use among Nursing Students in Morocco: A Cross-Sectional Study

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1. Introduction

Dietary habits adopted during university years play an important role in shaping long-term health outcomes. Unhealthy eating patterns, such as meal skipping and excessive consumption of energy-dense foods are among the leading risk factors for non-communicable diseases, including cardiovascular diseases, diabetes, and obesity. Thereby, risky dietary behaviors among university students are a public health issue due to their potential development into full-blown eating disorders and their impact on health and academic performance.

Recent evidence indicates that risky dietary practices remain highly prevalent among healthcare students despite their educational background. In fact, nursing students represent a population of particular interest because, as future healthcare professionals, they are expected to promote healthy lifestyles while maintaining healthy behaviors themselves. However, previous studies have reported that nursing students frequently engage in risky dietary practices such as meal skipping, excessive fast-food consumption, and restrictive dieting, highlighting the gap between nutritional knowledge and personal health behaviors.

Simultaneously, the growing use of artificial intelligence (AI) tools such as Chat Generative Pre-trained Transformer (ChatGPT) has transformed access to information including in the field of healthcare.

University students increasingly rely on generative AI systems for academic support, health education, and lifestyle guidance. Recent studies suggest that ChatGPT may improve access to nutrition information and facilitate self-directed learning; however, concerns remain regarding the accuracy, reliability, and personalization of AI-generated dietary recommendations.

In Morocco, little is known about the coexistence of risky dietary behaviors and the growing use of AI-based tools among nursing students. Therefore, this study aimed to assess the prevalence of risky dietary behaviors and explore ChatGPT use for nutrition-related practices among Moroccan nursing students.

2. Methods:

A quantitative cross-sectional descriptive study was conducted between January and June 2025, among Moroccan nursing students enrolled in the Higher Institute of Nursing Professions and Health Techniques of Meknes, in Morocco. The target population consisted of 745 students, and the sample size set at 254 was calculated using the Cochran's formula, based on a 95% confidence level and a 5% margin of error. Participants were selected through simple random sampling. Data were collected using a self-administered structured questionnaire including sociodemographic characteristics, dietary behaviors, and ChatGPT in nutrition related practices. Data were collected after obtaining

informed consent from all participants and in accordance with applicable ethical standards for research involving human subjects. The analysis of the data relied on descriptive statistics, and the processing was performed using Microsoft Excel and SPSS software version 30.

3. Results:

We recruited a total of 254 participants. The results revealed a fairly homogeneous demographic profile: the majority of the students were women (72%), participants aged between 20 and 24 years constituted the largest age group (65.4%), and the vast majority of respondents were single (99.21%). Regarding the nutritional status, nearly 80% of the sample had a body mass index (BMI) considered extreme. Risky dietary behaviors were frequently reported among participants. The most frequent behavior was meal skipping (70.5%). More than half of the students indicated frequent fast-food consumption (53.5%), or daily sugary and fat snacking (53.5%). One third of the participants reported experiencing episodes of binge eating (33%), while 18.9% reported following an unsupervised restrictive diet. Additionally, (14.96%) of participants used physical activity as a compensatory behavior. Regarding artificial intelligence use, ChatGPT appeared to be widely adopted among nursing students. The results showed that 60% of students searched for nutritional information via ChatGPT, while 11% of students used it to generate personalized dietary recommendations.

4. Discussion

The present study highlights the frequent risky dietary behaviors among nursing students in Meknes. Similar findings have also been reported in several studies, highlighting the widespread prevalence of unhealthy dietary behaviors among students.

Regarding artificial intelligence, our study revealed the growing integration of ChatGPT into students' health information-seeking behaviors. The finding that 60% of participants used ChatGPT to obtain nutrition-related information reflects the increasing accessibility and popularity of this tool and suggests that it is becoming important sources of health and nutrition information among nursing students. This practice raises important questions about digital health literacy. Another significant finding from our study reveals that only 11% of participants reported using ChatGPT to obtain personalized dietary recommendations. Although this proportion was relatively low, this practice may reflect excessive trust in AI-generated advice. Artificial intelligence systems cannot fully assess individual medical histories, nutritional requirements, or health conditions, which may increase the risk of inappropriate dietary decisions. Previous research has highlighted that students often recognize the benefits of ChatGPT while simultaneously expressing concerns about misinformation, reduced critical thinking, and overreliance on AI systems.

5. Conclusion

Risky dietary behaviors are highly prevalent among our sample. The use of ChatGPT for nutritional information and personalized dietary recommendations is also widespread. Nevertheless, concerns remain regarding the quality and reliability of AI-generated health information. Those findings underscore the need to promote healthy eating behaviors and ensure the critical and informed use of AI-based tools among nursing students. Further research is warranted to better understand this phenomenon and enhance students' well-being.

Keywords: Risky dietary behaviors, ChatGPT use, Nursing students, Morocco.

[COT1-12] Artificial Intelligence Applications in Addictive Eating Behaviors and Ultra-Processed Food Consumption: A Scoping Review

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1. Introduction

Artificial intelligence (AI) and machine learning (ML) have emerged as transformative technologies in health research, offering new opportunities to analyze complex behavioral, clinical, and environmental data [1]. In nutrition and eating behavior research, AI-based approaches are increasingly being used to identify dietary patterns, predict eating behaviors, screen for eating disorders, monitor food environments, and develop personalized nutrition interventions [2]. These technologies have the potential to improve dietary assessment, support behavioral change, and facilitate the early detection of eating disorders, food addiction, and addictive eating behaviors associated with ultra-processed food (UPF) [3].

Given the rapid expansion of AI applications in this field, a comprehensive synthesis of the existing evidence is needed. Therefore, this scoping review aimed to systematically map the existing literature on AI and ML applications in eating behavior research, food addiction, and UPF-related addictive eating behaviors.

2. Materials and Methods

A scoping review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) [4]. The review followed the Population–Concept–Context (PCC) framework.

The population included human participants of any age, as well as studies using nutrition-related digital or online content. The concept of interest was the application of AI and ML methods to eating behaviors, food addiction, addictive eating behaviors related to UPF consumption, eating disorders, dietary assessment, and food environment monitoring. The context encompassed all geographical settings and study populations.

Eligible studies were original research articles published during the last ten years (2016–2026). Studies were included if they employed AI techniques such as ML algorithms, deep learning, natural language processing, computer vision, clustering techniques, predictive modeling, or other computational intelligence methods applied to nutrition and eating behavior related domains.

Studies were excluded if they were reviews, editorials, protocols, animal studies, or did not contain an identifiable AI/ ML component. In addition, studies whose primary objective was to examine associations between dietary patterns and health outcomes, such as cardiovascular disease, obesity, diabetes, or other chronic diseases, were excluded unless they specifically addressed eating behaviors, food addiction, eating disorders, or related behavioral phenotypes.

3. Results

A total of 49 studies published between 2019 and 2026 were included. Most studies were published from 2023 onwards, reflecting the increasing interest in the application of AI/ ML to eating behavior and food addiction research. The studies were conducted across multiple countries. The United States accounted for the largest proportion of studies (n = 20), followed by China (n = 4), Australia (n = 3), and several other countries including Spain, Italy, France, Denmark, Canada, Iran, India, Germany, the Netherlands, Belgium, Singapore, Turkey, Brazil, and Palestine/United Arab Emirates. A small number of studies relied on multinational datasets or online content without a specific geographical location.

The included studies employed diverse study designs, including cross-sectional studies, cohort studies, randomized controlled trials, longitudinal studies, ecological momentary assessment studies, and mixed-methods approaches.

Sample sizes ranged from 15 participants to more than 363 534 individuals. Most studies included human participants, although some analyzed social media posts, online eating disorder related content, or electronic health records. The study populations were heterogeneous and included adolescents, university students, adults from the general population, individuals with overweight or obesity, patients with binge-eating disorder (BED), individuals with bulimia nervosa and other eating disorders, lactating women, preschool children, and participants recruited through digital health platforms.

Several nutrition-related domains were identified, with a predominant focus on eating disorders, particularly BED and bulimia nervosa. Other frequently investigated domains included eating behaviors, food addiction, and dietary patterns. Additional applications concerned personalized nutrition, dietary assessment, and UPF related behaviors.

A broad range of AI and ML techniques was identified. Frequently used methods included Random Forest, logistic regression based on MI models, elastic net and LASSO regularization techniques, clustering algorithms, natural language processing, deep learning, computer vision systems, connectome-based predictive modeling, and multimodal ML approaches. Neuroimaging-based predictive models were commonly employed in studies investigating food craving and eating disorder phenotypes. The studies relied on diverse data sources, including survey and cohort data, ecological momentary assessment datasets, neuroimaging data, electronic health records, wearable devices, mobile applications, and online content.

The primary objectives of AI applications were eating behavior phenotyping and classification, prediction of dietary and eating behaviors, and identification of food addiction and craving-related patterns. Several studies also used AI for dietary pattern derivation, risk prediction of eating disorders, and the development of personalized nutrition tools and digital interventions, including chatbots and recommendation systems.

4. Discussion

The findings demonstrate that AI applications extend beyond traditional dietary assessment and increasingly encompass behavioral prediction, personalized nutrition, digital health interventions, and neurobehavioral characterization of eating disorders.

A notable finding was the predominance of studies focusing on eating disorders, BED, and food addiction. This trend likely reflects the complexity of these conditions and the need for advanced analytical methods capable of integrating behavioral, clinical, neurobiological, and environmental data. Another important observation was the growing use of ecological momentary assessment, mobile health technologies, and digital platforms as data sources. These approaches allow the collection of real-time behavioral information and support the development of dynamic prediction models.

Despite these advances, important gaps remain. Few studies addressed UPF consumption, food environments, or population-level nutrition surveillance. Moreover, the heterogeneity of AI methods and reporting practices may limit comparability across studies. Future research should prioritize methodological transparency, external validation, and the integration of AI tools into public health nutrition practice.

5. Conclusion

This scoping review demonstrates the increasing application of AI and ML in nutrition and eating behavior research, particularly in eating disorders, food addiction, dietary pattern analysis, and personalized nutrition. AI methods were primarily used for phenotyping, prediction, and classification. Future research should expand the use of these approaches to address broader public health nutrition challenges such as UPF consumption.

Keywords: Artificial intelligence, Ultra-processed foods, Food addiction, Scoping review.

References

1. Fagherazzi G, Goetzinger C, Rashid MA, Aguayo GA, Huiart L. Digital Health Strategies to Fight COVID-19 Worldwide: Challenges, Recommendations, and a Call for Papers. J Med Internet Res. 16 juin 2020;22(6):e19284. doi:10.2196/19284 PubMed PMID: 32501804; PubMed Central PMCID: PMC7298971.



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2. Sak J, Suchodolska M. Artificial Intelligence in Nutrients Science Research: A Review. *Nutrients*. 22 janv 2021;13(2):322. doi:10.3390/nu13020322 PubMed PMID: 33499405; PubMed Central PMCID: PMC7911928.
3. Kelly JT, Campbell KL, Gong E, Scuffham P. The Internet of Things: Impact and Implications for Health Care Delivery. *J Med Internet Res*. 10 nov 2020;22(11):e20135. doi:10.2196/20135 PubMed PMID: 33170132; PubMed Central PMCID: PMC7685921.
4. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, Moher D, Peters MDJ, Horsley T, Weeks L, Hempel S, Akl EA, Chang C, McGowan J, Stewart L, Hartling L, Aldcroft A, Wilson MG, Garritty C, Lewin S, Godfrey CM, Macdonald MT, Langlois EV, Soares-Weiser K, Moriarty J, Clifford T, Tunçalp Ö, Straus SE. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med*. 2 oct 2018;169(7):467-73. doi:10.7326/M18-0850 PubMed PMID: 30178033.

[COT1-14] Smartphone addiction and students' mental health: A correlational study

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1. Introduction

The ubiquity of mobile technologies raises concerns about the psychological well-being of individuals, particularly young people. Smartphones are now an integral part of students' daily lives, whose academic and social activities often revolve around digital platforms. While they offer considerable advantages, their excessive use raises concerns about their detrimental effects on mental health and overall well-being (1). The concept of smartphone addiction is increasingly recognized as a behavioral addiction characterized by compulsive use, withdrawal symptoms, and functional impairments (2). Problematic use is more likely with prolonged daily use, often exceeding four hours of early morning use and intensive use of social media or messaging apps (1, 3–5). Epidemiologically, prevalence rates worldwide vary considerably depending on the context, reporting smartphone addiction in 20% to over 60% of university students (1, 3, 6). In Morocco, some recent studies have revealed addiction rates between 40 and 80% (7–10). This excessive use has been associated with repercussions on mental health, in terms of depression, anxiety, and stress (1,4,8,11) . To our knowledge, no study conducted at the ISPITSR has yet analyzed the interactions between depression, anxiety, stress, and smartphone addiction among students. This study aims to fill this gap by estimating the current prevalence of smartphone addiction and exploring its links with three psychological aspects. The main objective of this study is to assess the correlation between smartphone addiction and mental health among nursing students at the ISPITS in Rabat.

2. Materials and Methods

This is a correlational study conducted with 130 students from ISPITS Rabat in 2026. Participants were recruited by simple random sampling. The sample size was calculated using Yamane's formula with a 95% confidence level.

Data were collected using a pre-tested self-administered questionnaire, which included a socio-demographic section on participants and two validated scales in French. Data from the Smartphone Dependence Scale (SAS-SV) and the DASS-21 demonstrated very good internal consistency (Cronbach's $\alpha \geq 0.9$).

Participants were fully informed of the study's objectives and gave their informed consent for their participation and the use of the data collected. The protection of personal data was ensured by preserving the anonymity and confidentiality of the information. Prior authorization was obtained from the Institute's management before data collection began.

For data analysis, quantitative variables were presented as means $\pm$ standard deviations, while qualitative variables were presented as frequencies and percentages. Pearson's correlation coefficient was used to measure the strength of linear relationships. The threshold for statistical significance was set at $p \leq 0.05$. Statistical analyses were performed using SPSS software (version 18.0).

4. Results

The mean age of participants was 20.25 years (standard deviation: 1.54). Of these, 87 (67%) were female and 43 (33%) were male. The assessment revealed a prevalence of smartphone addiction of 43.8%, associated with high rates of anxiety, depression, and stress (82.3%, 70%, and 65.4%, respectively). Pearson correlation analysis validated the study's objective by confirming a significant positive correlation ($p < .001$) between smartphone addiction and mental health disorders, primarily characterized by stress ($r = 0.397$), anxiety ($r = 0.388$), and depression ($r = 0.384$).

5. Discussion

In our sample, the prevalence of smartphone addiction was 43.8%, which is consistent with other similar Moroccan studies revealing prevalences between 40% and 50% (7,8) . Regarding mental health disorders, our results reported prevalences of 82% for anxiety, 70% for depression, and 65% for stress. These prevalences are generally observed in similar student settings (12). Considering the correlations between variables, several studies have documented the association of problematic mobile phone use with mental health disorders among students (13–15) .

6. Conclusion

This correlation highlights a major public health problem. Students who excessively use their smartphones suffer from psychological vulnerability. Excessive smartphone use leads to addiction and harms their mental health.

Keywords: Behavioral addiction, cell -phone addiction, dependence, mental health, students.

References

1. Sohn SY, Rees P, Wildridge B, Kalk NJ, Carter B. Prevalence of problematic smartphone usage and associated mental health outcomes among children and young people: has systematic review , meta-analysis and GRADE of the evidence . BMC Psychiatry . Nov 29 2019; 19(1) : 356. doi: 10.1186/s12888-019-2350-x PubMed PMID: 31779637; PubMed Central PMCID: PMC6883663.
2. Billieux J, Maurage P, Lopez-Fernandez O, Kuss DJ, Griffiths MD. Can Disordered Mobile Phone Use Be Considered a Behavioral Addiction? An Update on Current Evidence and a Comprehensive Model for Future Research . Curr Addict Rep. June 1, 2015; 2(2) : 156 – 62. doi: 10.1007/s40429-015-0054-y
3. Zhong Y, Ma H, Liang YF, Liao CJ, Zhang CC, Jiang WJ. Prevalence of smartphone addiction among Asian medical professionals students : A meta-analysis of multinational observational studies . Int J Soc Psychiatry . seven 2022; 68(6) : 1171 - 83. doi: 10.1177/00207640221089535 PubMed PMID: 35422151.
4. Alhassan MA, Al-Otaibi EM, Bin Ofaysan MS, Alarjani KH, Alzuhairi MO, Alarfaj NS, et al. Smartphone Addiction and Its Psychosocial Correlates Among University Students . Cures . August 2025; 17(8) :e91165. doi: 10.7759/cureus.91165 PubMed PMID: 41018378; PubMed Central PMCID: PMC12475987.
5. Ahn JS, Jeong I, Park S, Lee J, Jeon M, Lee S, et al. App-Based Ecological Momentary Assessment of Problematic Smartphone Use During Examination Weeks in University Students : 6-Week Observational Study. J Med Internet Res . Feb 5 2025;27:e 69320. doi: 10.2196/69320 PubMed PMID: 39908075; PubMed Central PMCID: PMC11840384.
6. Olson JA, Sandra DA, Colucci ÉS, Al Bikaii A, Chmoulevitch D, Nahas J, et al. Smartphone addiction is increasing across the world: A meta-analysis of 24 countries. Comput Hum Behav . Apr 1 2022;129: 107138. doi:10.1016/j.chb.2021.107138
7. Choujaa H, Attouche N, Agoub M, Alami KM. Problematic smartphone use among Moroccan medical students . Eur Psychiatry . March 2023; 66(S1) :S 378-9. doi : 10.1192/j.eurpsy.2023.819
8. Archou R, Ouadrhiri M, Amazian M, Mouhoute N, Touil D, Aalouane R, et al. The relationship between smartphone addiction and anxiety : a cross-sectional study among Moroccan nursing students . Pan Afr Med J. 11 Feb 2025;50: 47. doi: 10.11604/pamj.2025.50.47.45274 PubMed PMID: 40353124; PubMed Central PMCID: PMC12065560.
9. Haddaouy AE, Miyah Y, Benjelloun M, Mengad A, Blaak H, Iziki H, et al. Smartphone addiction and sleep quality among nursing students in Meknes , Morocco: A cross-sectional study . Belitung Nurs J. Apr 19 2025; 11(2) : 133 - 41. doi: 10.33546/bnj.3718 PubMed PMID: 40256389; PubMed Central PMCID: PMC12008721.
10. Haddaouy AE, Blaak H, Elkhalladi J, Essaidi M, Iziki H, Es-Sabir F, et al. Mediating role of sleep quality in the relationship between smartphone addiction and academic performance among nursing students in Morocco: a cross-sectional study . BMC Nurs. Oct 14 2025; 24(1) : 1281. doi: 10.1186/s12912-025-03949-2
11. Nikolic A, Bukurov B, Kocic I, Vukovic M, Ladjevic N, Vrhovac M, et al. Smartphone addiction, sleep quality , depression , anxiety , and stress among medical students . Front Public Health. 2023;11: 1252371. doi: 10.3389/fpubh.2023.1252371 PubMed PMID: 37744504; PubMed Central PMCID: PMC10512032.
12. Siraj A. Prevalence of anxiety among students at the Higher Institute of Nursing and Health Professions, Agadir. Rev LaRSLAME Société Lang Art Médias Educ. 22 Oct 2025; 12(12). doi:10.34874/IMIST.PRSM /larslam-i12.60912
13. De-Sola Gutiérrez J, Rodríguez de Fonseca F, Rubio G. Cell-Phone Addiction: A Review . Front Psychiatry . Oct 24 2016; 7. doi: 10.3389/fpsy.2016.00175
14. Demirci K, Akgönül M, Akpinar A. Relationship of smartphone use severity with sleep quality , depression , and anxiety in university Students . J Behav Addict. June 1, 2015 ; 4(2) : 85–92 . doi: 10.1556/2006.4.2015.010



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15. Smartphone addiction. In: Adolescent Addiction [Internet]. Academic Press; 2020 [cited 13 May 2026]. pp. 215–40 . Available from: <https://www.sciencedirect.com/science/chapter/edited-volume/pii/B9780128186268000086> doi: 10.1016/B978-0-12-818626-8.00008-6

[COT1-15] Problematic smartphone use and dry eye disease: what is the association among Moroccan adolescents?

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1. Introduction

Smartphones have become essential components of daily life, yet their habitual check can evolve into problematic smartphone use (PSU) when associated with negative outcomes [1]. PSU has been widely linked to somatic health issues, including musculoskeletal pain, eye discomfort, and sleep disturbances [2,3]. Specifically, chronic sleep disorders can impair the impulsivity/inhibition balance, fostering risky behaviors—a category in which PSU itself is often classified [4]. Beyond sleep and cognitive control, excessive screen time stands as a major risk factor for ocular complaints, such as dry eye disease (DED) [5]. Concurrently, this digital immersion fosters an increasingly sedentary lifestyle, particularly among adolescents [6]. Although a growing body of research has explored the decline in physical activity driven by PSU, the complex interconnections between PSU, DED, sleep disorders, and physical inactivity remain unexplored among Moroccan adolescents. Therefore, this study aims to test the hypothetical model of Figure 1 among a sample of Moroccan high school students.

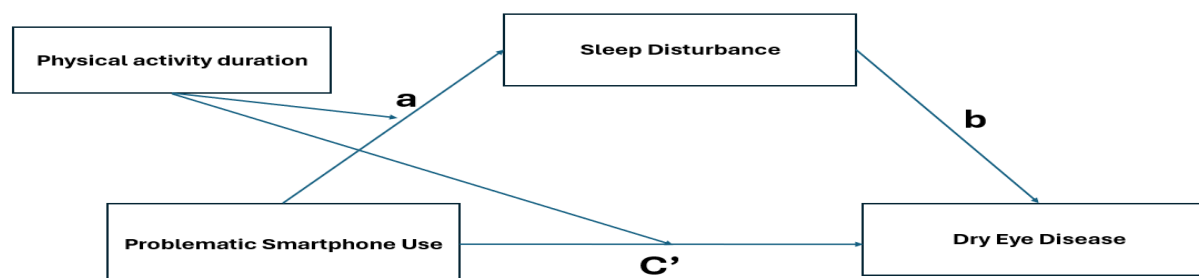


Figure 1. Moderated mediation model with Problematic Smartphone Use (PSU) (predictor), Sleep Disturbance (SD) (mediator), physical activity duration (moderator) and Dry Eye Disease (DED) (outcome). a, link between PSU and SD; b, link between SD and DED; c', link between PSU and DED (direct effect).

2. Materials and Methods

This cross-sectional study was conducted from December 2023 to May 2024 across the twelve regions of Morocco. Participation was voluntary and anonymous, and no financial or academic credit was awarded for participation. Ethical approval for this project was obtained from the hospital-university ethics committee of Sidi Mohamed Ben Abdellah University (N°16/22).

For data collection, a three-section questionnaire was developed. The first part provided information on the study objectives and obtained participant consent. The second gathered sociodemographic data (age, gender, residential area (urban/rural), socioeconomic status, and parental education level). The third consisted of the following validated scales: the Smartphone Addiction Scale-Short Version (SAS-SV), the Dry Eye Questionnaire-5 (DEQ-5), and the Insomnia Severity Index (ISI).

Furthermore, participants reported the number of days per week they engaged in physical activity for at least 60 minutes. These durations were then dichotomized into two categories: less than 180 minutes vs. greater than or equal to 180 minutes per week. Finally, a binary (yes/no) question screened for prior eye surgery or active eye conditions.

3. Results

A total of 2,202 high school students were recruited. Among them, 50.0% (95% CI: 47.91%–52.08%) were identified as problematic smartphone users, 39.3% (95% CI: 37.25%–41.34%) suffered from dry eye disease (DED), and 38.3% (95% CI: 36.26%–40.33%) experienced sleep problems. Regarding physical activity, 44.0% of participants engaged in less than 180 minutes per week, compared to 56.0% who practiced 180 minutes or more. Students active for less than 180 minutes per week exhibited significantly higher mean scores than their more active counterparts for PSU ($t = 22.17$, $p < 0.001$), ISI ($t = 47.28$, $p < 0.001$), and DEQ-5 ($t = 73.97$, $p < 0.001$).

Additionally, a significant association was found between PSU and a daily smartphone duration ≥ 5 hours ($OR = 2.63$, $p < 0.001$), a session duration ≥ 1 hour ($OR = 2.56$, $p < 0.001$), and smartphone use both immediately after waking up and before going to bed ($OR = 16.00$, $p < 0.001$). Finally, girls were more likely to screen positive for PSU than boys ($OR = 1.32$, $p = 0.002$), whereas boys reported higher engagement in physical activity ($OR = 1.83$, $p < 0.001$). Furthermore, PSU was significantly and positively associated with both ISI and DEQ-5 scores, while ISI was also positively correlated with DEQ-5 (Table 1).

Table 1. Descriptive statistics and correlations of Problematic Smartphone Use, Insomnia Severity Index, and Dry Eye Questionnaire-5.

	M(SD)	Range	Skewness	Kurtosis	ISI	DEQ-5
PSU	32.04(11.221)	10-60	0.169	-0.647	0.544**	0.663**
ISI	7.94(5.109)	0-27	1.009	0.701	-	0.806**
DEQ-5	3.51(3.021)	0-22	0.783	0.07		-

Note. PSU=Problematic Smartphone Use; ISI= Insomnia Severity Index; DEQ-5= Dry Eye Questionnaire-5; SD = Standard Deviation; ** $p<0.01$

The moderated mediation analysis yielded significant results. The overall model was statistically significant, $F(6, 2195) = 2621.87$, $p < 0.001$, $R^2 = 0.895$ and the moderating effect was significant (index = -0.0218 , 95% CI = $[-0.0260, -0.0173]$). After controlling for gender and residential area, both the conditional direct effect (path c') and the conditional indirect effect of PSU on DEQ-5 remained significant ($p < 0.001$). Specifically, these effects were notably stronger for participants engaging in less than 180 minutes of physical activity per week compared to those practicing 180 minutes or more (Figure 2).

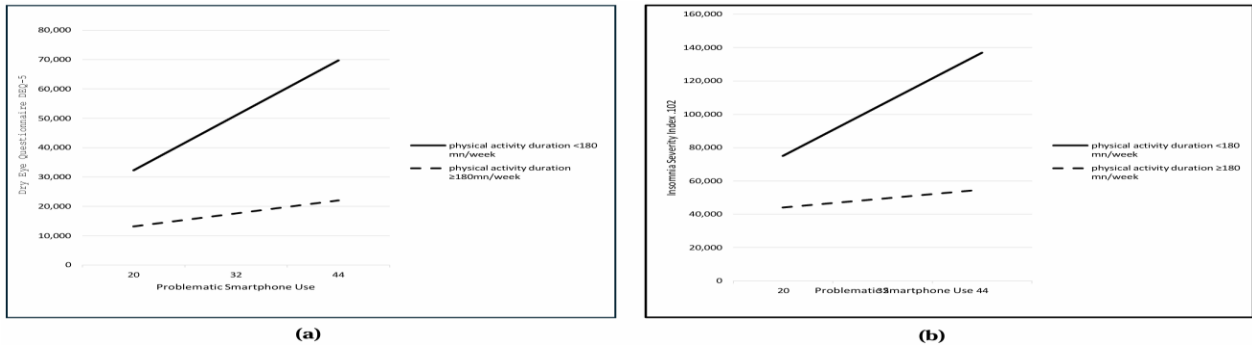


Figure 2: Moderating effect of physical activity duration on the relationships between problematic smartphone use and (a) dry eye questionnaire (DEQ-5) scores, and (b) insomnia severity index (ISI).

5. Conclusion

In conclusion, this study demonstrates that problematic smartphone use is significantly associated with dry eye disease among adolescents, a relationship that is further exacerbated by poor sleep quality and physical inactivity (less than 180 minutes per week). Conversely, engaging in 180 minutes or more of weekly physical activity appears to buffer these negative outcomes, potentially mitigating sleep disturbances and the severity of PSU, which in turn may alleviate ocular symptoms. Consequently, implementing early school-based interventions that promote physical activity and healthy digital habits is crucial to fostering long-term adolescent well-being.

Keywords: problematic smartphone use; physical activity; dry eye disease; sleep disturbance, High school students

References

1. Park J., Jeong J.E., Rho M.J. Predictors of Habitual and Addictive Smartphone Behavior in Problematic Smartphone Use. *Psychiatry Investig.* 2021; 18:118. doi: 10.30773/pi.2020.0288.
2. Yang J., Fu X., Liao X., Li Y. Association of problematic smartphone use with poor sleep quality, depression, and anxiety: A systematic review and meta-analysis. *Psychiatry Res.* 2020; 284:112686. doi: 10.1016/j.psychres.2019.112686.
3. Yu S., Sussman S. Does Smartphone Addiction Fall on a Continuum of Addictive Behaviors? *Int. J. Environ. Res. Public Health.* 2020; 17:422. doi: 10.3390/ijerph17020422.
4. López-Muciño, LA. et al. Sleep loss and addiction. *Neurosci. Biobehav. Rev.* 141, 104832 (2022).
5. Al-Mohtaseb, Z., Schachter, S., Shen Lee, B., Garlich, J., Trattler, W. The Relationship between dry eye disease and digital screen use. *Clin. Ophthalmol. Auckl NZ.* 15, 3811–20 (2021).
6. Galor, A. et al. TFOS lifestyle: impact of lifestyle challenges on the ocular surface. *Ocul. Surf.* 28:262–303(2023).

[COT1-19] Problematic ChatGPT Use: Validation of the Arabic Version of the PCUS (PCUS-Ar)

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1. Introduction

Large-scale language model (LLM) technology has become a major technological milestone in recent years and is now used by millions of people worldwide. These tools can help users with many everyday tasks, such as finding information, generating content, solving problems, supporting academic work, and assisting with various personal and professional activities. Among the various applications powered by LLMs, ChatGPT has emerged as one of the most popular and widely used LLM powered application. By 2026, approximately 900 million people were using it worldwide, which represents nearly 11% of the global population. Its ease of use and diverse capabilities have contributed to this increasing adoption. As a result, ChatGPT has become integrated into many aspects of daily life, including education, work, and personal activities.

University students are one of the most active users of ChatGPT, since it has facilitated many of their tasks. It offers academic assistance, encourages independent learning, helps with study and writing, and can provide emotional support as well. With the tool becoming embedded in everyday routines, a new concern has arisen: that some students may develop a pattern of use that is problematic and has features resembling behavioral addiction, such as preoccupation, loss of control, tolerance, conflict with academic duties, and deception use. Students are especially exposed since they are highly familiar with technology and since the tool is at the heart of their academic work.

To measure this phenomenon, Yu, Chen, and Yang (2024) developed and validated the Problematic ChatGPT Use Scale (PCUS) in Taiwan, a single-factor instrument of 11 items with good psychometric properties. So far, however, no validated Arabic version has been available, which limits both research and screening in Arabic-speaking contexts. The present study therefore examines the psychometric properties of the Arabic version of the scale (PCUS-Ar) in a sample of Moroccan university students, focusing on its factor structure through exploratory and confirmatory analyses.

2. Materials and Methods

Participants. Our study included 600 Moroccan university students from universities across all regions of Morocco. The age of the participants ranged from 18 to 56 years ($M = 24.54$, $SD = 6.83$). Most participants were female, single, and lived in urban areas. Regarding educational level, approximately half of the participants were undergraduate students, while the remaining participants were master's and doctoral students.

Procedure. In line with the recommendation of Gerbing and Hamilton, which was used by Yu et al. (2024), the sample was randomly divided into two equal groups. The first sample ($n = 300$) was used for the exploratory factor analysis (EFA) whereas the second sample ($n = 300$) was used for the confirmatory factor analysis (CFA). All analyses were performed in JASP with maximum likelihood (ML) estimation, and Varimax rotation was used in the EFA.

3. Results

Exploratory factor analysis. The data were clearly suitable for factoring: the Kaiser-Meyer-Olkin index reached $KMO = 0.922$, and Bartlett's test of sphericity was highly significant ($\chi^2(55) = 2097.381$, $p < 0.001$). A single factor was retained: its eigenvalue was 6.358, well above the Kaiser criterion of 1.0, and it explained 53.9% of the total variance. The three retention criteria agreed completely: the Kaiser rule, the scree test, and parallel analysis all pointed to one factor. All items loaded on this single factor, and most of them had loadings above 0.70. Every loading exceeded the minimum acceptable value of 0.30 proposed by Comrey and Lee, with the single exception of item 11, which sat at the lower limit

and can be regarded as borderline. Internal consistency was excellent (Cronbach's $\alpha = 0.898$; McDonald's $\omega = 0.896$), well above the reliability standards recommended by Nunnally and Bernstein.

Confirmatory factor analysis (baseline model). The one-factor structure was then tested on the second sub-sample. The baseline model, estimated before any refinement, was statistically significant ($\chi^2 = 130.363$, $df = 44$, $p < 0.001$), but the χ^2/df ratio of 2.96 stayed below the usual cut-off of 3.0, which already indicates a generally acceptable fit. All incremental fit indices exceeded the conventional 0.90 criterion for acceptable fit : CFI = 0.943, TLI = 0.929, IFI = 0.944, and NFI = 0.917. The SRMR was good (0.046, below the 0.08 benchmark), and the RMSEA was 0.081 (90% CI [0.065; 0.097]), well within the acceptable range.

4. Discussion

Overall, the exploratory analyses support the presence of a single underlying factor in the PCUS-Ar. The excellent KMO value and significant Bartlett's test confirmed the suitability of the data for factor analysis. In addition, the Kaiser criterion, scree plot, and parallel analysis all pointed to the same one-factor solution, providing consistent evidence for the unidimensional nature of the scale. Factor loadings were generally high across the 11 items, and even the lowest loading remained above the recommended threshold, indicating that all items contributed meaningfully to the construct being measured.

The confirmatory step is consistent with this picture. On a separate sub-sample, the one-factor model reached an acceptable fit, with a chi-square-to-df ratio below 3, a good SRMR, and all incremental indices above the conventional 0.90 criterion. This shows that the single-factor structure holds well across two independent samples. The high values of both reliability coefficients further confirm that PCUS-Ar scores can be used with confidence. Our baseline model also compares favourably with the initial model reported by Yu and colleagues in the original study. Their first, unadjusted model showed an uneven fit: the RMSEA reached 0.13 and the chi-square was nearly ten times its degrees of freedom ($\chi^2/df = 9.59$). Our baseline behaved much better on these points, with an RMSEA of 0.081 and a chi-square-to-degrees-of-freedom ratio of 2.96, while the SRMR was comparable in both studies (0.046 vs 0.047).

The comparison with the original study is particularly noteworthy. Although both versions support a one-factor structure, the Arabic version demonstrated a more satisfactory fit at the baseline stage. This suggests that the underlying construct of problematic ChatGPT use was successfully preserved during the translation and cultural adaptation process. The similarity in factor structure and reliability estimates across studies further indicates that the PCUS-Ar captures the same core dimension assessed by the original instrument while maintaining good psychometric performance in a different linguistic and cultural context.

5. Conclusion

The Arabic validation of the PCUS among Moroccan university students showed a unidimensional factor structure and excellent internal consistency. These results are aligned with those reported in the original version of the scale and support the reliability and structural validity of the PCUS-Ar. As part of the ongoing validation process, we will examine convergent and divergent validity, along with additional analyses to provide a more complete assessment of the PCUS-Ar.



[COT1-20] Surexposition aux écrans et retard de langage simple chez l'enfant d'âge préscolaire : étude transversale préliminaire dans la région Fès-Meknès (Maroc)

(Overexposure to screens and simple language delay in preschool children: preliminary cross-sectional study in the Fès-Meknes region (Morocco))

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1. Introduction

Ces dernières années, l'usage croissant des écrans chez les jeunes enfants a suscité de nombreuses interrogations quant à ses effets sur leur développement, notamment langagier. Durant la période sensible de 3 à 5 ans, le langage connaît une progression rapide qui repose essentiellement sur les interactions sociales et verbales. Or, la surexposition aux écrans, qu'elle soit passive ou interactive, tend à réduire le temps consacré aux échanges oraux et aux jeux symboliques. De nombreuses études suggèrent un lien entre cette surexposition et l'apparition de retards de langage simple, se manifestant par un vocabulaire limité, des difficultés de construction syntaxique ou une faible intelligibilité.

Dans notre contexte marocain, peu d'études ont été publiées sur l'association entre la surexposition aux écrans et le retard de langage simple chez les enfants marocains âgés de 3 à 5 ans. Bien que certaines preuves établissent un lien entre une exposition excessive aux médias intelligents et le retard de parole chez les enfants, la nature exacte de cette association reste complexe et encore mal comprise surtout dans les pays en voie de développement. Ainsi, cette étude vise à décrire de manière approfondie la relation entre le retard de parole et l'utilisation des médias intelligents chez les enfants marocains âgés de 3 à 5 ans.

2. Matériel et Méthodes

Il s'agit d'une étude observationnelle, transversale, conduite à la région de Fès/Meknès chez les enfants atteints d'un retard de langage simple. Seuls les enfants suivis par un (e) orthophoniste participant(e) à l'étude et répondant à l'ensemble des critères d'éligibilité ont été inclus. Les critères d'inclusion comprenaient un âge compris entre 3 et 5 ans, un diagnostic de retard simple du langage confirmé par un(e) orthophoniste, la participation volontaire des parents ainsi que l'absence de pathologies neurologiques ou sensorielles susceptibles d'interférer avec le développement du langage. À l'inverse, ont été exclus les enfants présentant un trouble neurodéveloppemental, une pathologie auditive ou visuelle sévère susceptible d'influencer le développement langagier, ou un retard de langage attribuable à un bilinguisme précoce, afin d'éviter tout biais lié à l'influence de l'exposition à plusieurs langues.

Afin de garantir la compréhension optimale du questionnaire par les parents participants, le questionnaire CoSE a été traduit en arabe dialectal marocain. Cette adaptation linguistique et culturelle visait à assurer une meilleure accessibilité, une plus grande fiabilité des réponses, ainsi qu'une meilleure adhésion des familles à l'étude.

L'étude a été conduite dans le respect des principes éthiques en vigueur. La participation était volontaire, anonyme et confidentielle.

3. Résultats et Discussion

Les données sociodémographiques de notre échantillon (N = 73) révèlent des tendances largement en accord avec la littérature scientifique sur le développement langagier chez l'enfant. La tranche d'âge la plus représentée est celle des enfants âgés de 4 ans et demi (31,5%), suivie par les enfants de 5 ans (23,3 %) et de 3 ans (21,9 %). Cette répartition suggère que les difficultés de langage deviennent plus visibles et préoccupantes à partir de 4 ans, moment où les

attentes en matière de communication orale augmentent dans les contextes préscolaires. La répartition selon le sexe montre une prédominance des garçons (57,5 %) par rapport aux filles. En effet, la littérature montre de manière constante une surreprésentation masculine dans les troubles langagiers, notamment dans les retards de langage simples.

Cette étude a examiné les pratiques familiales et leurs effets possibles afin de déterminer comment le temps passé devant un écran affectait le développement du langage des enfants marocains âgés de trois à cinq ans. Les résultats font état d'une situation préoccupante, caractérisée par une surutilisation généralisée des écrans et des comportements qui s'écartent des lignes directrices mondiales. D'après les données, les écrans sont présents dans tous les foyers marocains, les téléviseurs (97,3%) et les téléphones (100%) représentant la majorité des écrans. Cette saturation technologique s'accompagne d'une exposition précoce : 58,9 % des enfants sont exposés avant ou dès l'âge de 2 ans, et 37 % le sont à 3 ans. L'usage des écrans est souvent passif et non supervisé. Par exemple, 74 % des enfants utilisent des écrans pendant les repas, et 79,5 % y ont recours lorsque leurs parents sont occupés. Ces pratiques réduisent significativement les opportunités d'interactions verbales, pourtant essentielles au développement du langage. De plus, 52,1 % des enfants accèdent seuls à YouTube, et 75,3 % regardent des dessins animés sans accompagnement. Ces résultats confirment les risques liés à une exposition solitaire, qui montre que les écrans non interactifs limitent les échanges linguistiques et cognitifs.

Le temps d'écran quotidien dépasse souvent les seuils recommandés : 64,4 % des enfants utilisent les écrans plus d'une heure par jour. Par ailleurs, 74 % des enfants sont exposés aux écrans avant de dormir, une pratique qui peut perturber le sommeil et, les capacités cognitives et langagières. Les écrans semblent également se substituer aux interactions familiales. Ils sont perçus comme des outils de "tranquillité" (27,4 %) ou sources de tensions (31,5 %) plutôt que d'échanges (24,7 %). Cette dynamique limite les interactions parent-enfant, qui sont pourtant un pilier de l'acquisition du langage. L'environnement familial apparaît peu régulé : seuls 45,2 % des foyers ont instauré des règles d'usage des écrans, et 43,8 % des enfants ont une télévision dans leur chambre. Ces chiffres reflètent un manque de sensibilisation aux risques, qui soulignent que les parents utilisent souvent les écrans comme "baby-sitters numériques".

5. Conclusion

Ce travail souligne l'urgence de sensibiliser les familles, les professionnels de santé et les acteurs éducatifs à l'importance d'un usage modéré et encadré des écrans, adapté à l'âge de l'enfant. Il met également en lumière le besoin d'instaurer des politiques de prévention efficaces et de promouvoir des environnements favorisant les interactions humaines, la communication, le jeu et la créativité.

Mots-clés : Surexposition aux écrans ; retard de langage simple ; enfants d'âge préscolaire ; Maroc.

Keywords: *Overexposure to screens; simple language delay; preschoolers; Morocco.*



THEME 2 : EPIDEMIOLOGY OF CANCER

[COT2-5] Épidémiologie du cancer de la cavité orale au Maroc

(Epidemiology of oral cavity cancer in Morocco)

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1. Introduction

Le cancer de la cavité orale constitue l'une des principales tumeurs malignes des voies aérodigestives supérieures et représente un problème majeur de santé publique. Malgré les progrès diagnostiques et thérapeutiques, son pronostic demeure fortement dépendant du stade de découverte, les formes avancées étant associées à une mortalité et une morbidité élevées.

Au Maroc, les données disponibles proviennent principalement des registres régionaux du cancer, des centres hospitaliers universitaires et des facultés de médecine dentaire. Elles suggèrent une prédominance masculine, une survenue essentiellement après 40 ans et une fréquence importante des diagnostics tardifs.

Cette revue descriptive vise à synthétiser les principales données épidémiologiques relatives au cancer de la cavité orale au Maroc afin de mieux caractériser son profil et d'identifier les principaux défis de santé publique associés.

2. Matériel et Méthodes

Une revue descriptive de la littérature a été réalisée à partir des registres régionaux du cancer, des rapports institutionnels, des données du Centre International de Recherche sur le Cancer (CIRC/IARC) ainsi que des études publiées par les centres hospitaliers universitaires et les facultés de médecine dentaire marocaines.

Les données extraites concernaient l'incidence, les caractéristiques démographiques, les localisations anatomiques, les types histologiques et les principaux facteurs de risque. Les résultats ont été synthétisés de manière narrative afin de dresser un état des lieux de l'épidémiologie du cancer de la cavité orale au Maroc.

3. Résultats

Selon le Registre du Grand Casablanca (2018–2021), 617 cas de cancers des voies aérodigestives supérieures ont été enregistrés, dont 240 cas concernaient spécifiquement la lèvre, la langue et la cavité orale. L'incidence brute et standardisée était respectivement de 1,3 et 1,2 cas pour 100 000 habitants.

L'ensemble des études marocaines rapporte une prédominance masculine, les hommes représentant généralement entre 60 % et 70 % des patients. Plus de 90 % des cas surviennent après l'âge de 40 ans, avec un pic de fréquence entre la cinquième et la septième décennie de vie.

L'étude cartographique nationale coordonnée par la Faculté de Médecine Dentaire de Rabat, portant sur 1453 patients, a montré que 91,3% des cas survenaient après 40 ans, que les hommes représentaient 63% des patients et que le carcinome épidermoïde constituait le type histologique dominant. Les séries hospitalières réalisées à Casablanca et Marrakech ont rapporté des résultats comparables.



La langue constitue la localisation anatomique la plus fréquemment observée, suivie du plancher buccal, de la muqueuse jugale, des gencives et des lèvres. Le carcinome épidermoïde représente la forme histologique prédominante dans la grande majorité des cas.

Le tabagisme demeure le principal facteur de risque identifié. D'autres facteurs ont également été rapportés, notamment l'association tabac-alcool, la mauvaise hygiène bucco-dentaire et les déterminants socio-économiques défavorables.

4. Discussion

Les données disponibles mettent en évidence un profil épidémiologique relativement homogène du cancer de la cavité orale au Maroc, caractérisé par une prédominance masculine, une survenue après 40 ans et une forte association avec le tabagisme.

Le principal défi demeure le retard diagnostique. Dans l'étude nationale de Rabat, plus de la moitié des patients consultaient après plus de six mois d'évolution des symptômes, favorisant le diagnostic à des stades avancés et réduisant les possibilités thérapeutiques conservatrices.

Le cancer oral présente pourtant un potentiel important de dépistage précoce grâce à l'examen visuel des muqueuses buccales. Le renforcement de la formation des professionnels de santé, l'intégration systématique du dépistage lors des consultations dentaires et l'amélioration de la couverture des registres du cancer constituent des priorités pour la santé publique.

5. Conclusion

Le cancer de la cavité orale représente un problème important de santé publique au Maroc. Les données disponibles montrent une prédominance masculine, une survenue principalement après l'âge de 40 ans et une prédominance du carcinome épidermoïde. La langue constitue la localisation la plus fréquemment observée tandis que le tabagisme demeure le principal facteur de risque.

L'amélioration du dépistage précoce, le renforcement de la lutte antitabac et le développement de la surveillance épidémiologique nationale apparaissent essentiels pour réduire la morbidité et la mortalité associées à cette pathologie.

Mots-clés : Cancer de la cavité orale, Maroc, Épidémiologie, Santé publique, Dépistage

Keywords: Oral cavity cancer, Morocco, Epidemiology, Public health, Screening

[COT2-6] Health-related quality of life among women with breast cancer in the Souss-Massa Region: A cross-sectional study

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1. Introduction

Health-related quality of life (HRQoL) is considered an important determinant in the care of patients being treated for cancer. It is a multidimensional concept that encompasses the perception of both positive and negative aspects of dimensions such as physical, emotional, social, and cognitive functioning, as well as the negative aspects of somatic discomfort and other symptoms caused by a disease or its treatment [1]. Managing breast cancer care involves several treatment strategies, most of which are aggressive and result in physical, psychological, and social consequences [2]. Indeed, the HRQoL of women with breast cancer is severely impaired. Nevertheless, better identification of these consequences could lead to an improvement in HRQoL [3].

Furthermore, exploring the HRQoL is of paramount importance. On the one hand, it helps alleviate symptoms, improve rehabilitation care, and optimize therapeutic interventions. On the other hand, it enables the identification of potential issues, thereby assisting future patients in better understanding their disease and treatment. Moreover, HRQoL assessment contributes to clinical decision-making by predicting treatment outcomes and providing prognostic value [4]. The primary objective of this study was to assess HRQoL and its various dimensions among women diagnosed with breast cancer in the Souss-Massa region.

2. Materials and Methods

Study Design and Study Population

This is a multicenter cross-sectional study conducted among Moroccan women being treated for breast cancer who attend oncology care centers (both public and private) in the Souss-Massa region of southern Morocco. Patients were recruited during treatment sessions and follow-up visits based on eligibility criteria. Informed consent was obtained from the women after the study objectives were explained to them. Health-related quality of life was assessed using the validated Moroccan dialect version of the QLQ-C30 scale.

Statistical Analysis

Quantitative data are described using the mean $\pm$ standard deviation for variables with a normal distribution, and as the median and interquartile range (IQR) for variables with a skewed distribution. Qualitative variables are presented as counts and frequencies. Statistical analyses were performed using Jamovi software, version 2.2.3.

Ethical Considerations:

All procedures were conducted in accordance with ethical standards, as outlined in the Declaration of Helsinki and its subsequent amendments; principles of confidentiality and anonymity were upheld. Ethical approval was granted by the Ethics Committee for Biomedical Research at the MOHAMMED V Faculty of Medicine and Pharmacy in Rabat.

3. Results

A total of 270 patients participated in this study. Regarding sociodemographic and personal characteristics, the mean age of the patients was 49±10 years, ranging from 28 to 80 years. Two-thirds (64%) of the patients had no formal education. Nearly half of the patients (40.8%) lived in rural areas. Almost all of the patients lived with their families, and most (68%) were married. Regarding clinical characteristics, invasive breast carcinoma (IBC) was the most commonly identified (95%) among study participants. Nearly half (45.3%) of the patients were diagnosed with TNM stage III disease.

Table 1. Description of the HRQoL dimensions of the QLQ-C30

Dimensions	Median [IQR]	Mean ± standard deviation	Min-Max
GHS/QOL	33.33 [25 ; 66.67]	41.59± 22.56	8.33-83.34
Functions			
PF	60 [40 ;73.41]	57.47 ±24.32	0-100
RF	33.33 [16.67 ;66,67]	43.97± 34.78	0-100
EF	33.33 [16.67 ;66,67]	38.03± 29.28	0-100
CF	50 [33.33 ;66,67]	48.78 ±27.80	0-100
SF	83.33 [50 ;100]	75.20 ±28.08	0-100
Symptoms			
FA	55.56 [44.44 ;88,89]	61.23± 27.20	0-100
NV	16.67 [0 ;50]	26.15±27.35	0-100
PA	50 [16,67 ;66,67]	44.77±29.27	0-83.33
DY	33.33 [0 ;66,67]	38.92±34.45	0-100
SL	33.33 [0 ; 66,67]	42.82±37.58	0-100
AP	33.33 [0 ; 100]	49.73±39.70	0-100
DI	0 [0 ;33.33]	18.17±32.44	0-100
CO	0 [0 ;33.33]	24.20±36.06	0-100
FI	66.67 [33.33 ;100]	70.83±34.47	0-100

PF: physical function; RF: role function; SF: social function; CF: cognitive function; EF: emotional function; FA: fatigue; NV: nausea and vomiting; PA: pain; DY: dyspnea; SL: insomnia; AP: anorexia; DI: diarrhea; CO: constipation; FI: financial difficulties; GHS/QOL: global health status/quality of life.

4. Discussion

In this study, the QLQ-C30 scores were similar to those reported in several other studies. With regard to domains, the scores ranged from 33.33 [16.67; 66.67] for the role function and emotional function—which were the most impaired—to 83.33 [50; 100] for the social function, which was the least impaired. Similarly, the Moroccan study by Haddou Rahou (2017) showed that the lowest score corresponded to role function, with a mean of 25.5 ± 23.5 [5]. Our results were similar to those of a recent study (2024) conducted in the Amhara region of Ethiopia. That study found that most female patients had poor emotional functioning and poor physical functioning, at 80.9% and 71.5%, respectively [6]. In a 2024 study conducted in a similar cultural context in Saudi Arabia, role functioning also had the lowest score (48.61), while social functioning had the highest score (56.61) [7]. This result was also similar in Bahrain [8].

Thus, the results of the QLQ-C30 symptom scores revealed that the most severe symptoms were financial difficulties (55.56 [44.44; 88.89]), fatigue (55.56 [44.44; 88.89]), and pain (50 [16.67; 66.67]). Next, the symptoms of moderate intensity, with a median of 33.33 [0; 66.67], were dyspnea, insomnia, and anorexia. Similarly, the study by Haddou Rahou (2017) found that 59.5% of patients experienced financial difficulties related to CS, and fatigue, insomnia, and anorexia were identified as the most distressing symptoms [5]. Fatigue was identified as a severe symptom in several studies [5], [8], [9]. Furthermore, our results showed that constipation and diarrhea were less common among study participants; the same finding was reported in another recent study in Ethiopia [6].

The present study demonstrated that the global health status (GHS)/ QoL of patients with breast cancer was impaired, with a median score of 33.33 [25-66.67] and a mean score of 41.59 ± 22.56 . In comparison, the study conducted by Haddou Rahou et al. reported a slightly higher GHS/QoL score (53.4 ± 17.7) than that observed in our study[5]. Furthermore, the summary score, which integrates both functional and symptom scales, averaged 58.26 ± 17.09 . Similarly, a systematic review assessing health-related quality of life (HRQoL) among women with breast cancer in low- and middle-income Asian countries reported global QoL scores based on the EORTC QLQ-C30 questionnaire ranging from 56.32 ± 25.42 to 72.48 ± 15.68 [10]. Comparable findings were reported in a study conducted in Saudi Arabia in 2024, which revealed that Saudi women diagnosed with breast cancer experienced poor quality of life, with a global health status score of 55.41 [7].

5. Conclusion

Our findings indicate that HRQoL is markedly compromised among women diagnosed with breast cancer, underscoring the multifaceted challenges associated with the disease and its treatment. These results highlight the urgent need to integrate comprehensive and patient-centered supportive care services into routine oncology practice. Such interventions should address not only physical symptoms but also the psychological, social, and functional dimensions of well-being, thereby enhancing patients' resilience, emotional adjustment, and overall quality of life.

Keywords: Breast cancer, HRQoL, Souss-Massa region

References

- [1] U.-S. Lehto, M. Ojanen, and P. Kellokumpu-Lehtinen, "Predictors of quality of life in newly diagnosed melanoma and breast cancer patients," *Annals of Oncology*, vol. 16, no. 5, pp. 805–816, May 2005, doi: 10.1093/annonc/mdi146.
- [2] S. Lantheaume and Fernandez, "Après cancer du sein et qualité de vie. Mme J., 41 ans," p. 11, 2012.
- [3] T. Paraskevi, "Quality of life outcomes in patients with breast cancer," *Oncol Rev*, vol. 6, no. 1, p. 2, Jan. 2012, doi: 10.4081/oncol.2012.e2.
- [4] K. Haraldstad et al., "A systematic review of quality of life research in medicine and health sciences," *Qual Life Res*, vol. 28, no. 10, pp. 2641–2650, Oct. 2019, doi: 10.1007/s11136-019-02214-9.
- [5] B. H. Rahou et al., "Quality of Life among Moroccan Women Undergoing Treatment of Breast Cancer," *Journal of Advances in Medicine and Medical Research*, pp. 1–11, May 2017, doi: 10.9734/BJMMR/2017/33772.
- [6] T. Alem, D. Nigatu, A. Birara, T. Fetene, and M. Giza, "Quality of life of breast cancer patients in Amhara region, Ethiopia: A cross-sectional study," *PLOS ONE*, vol. 19, no. 6, p. e0305263, Jun. 2024, doi: 10.1371/journal.pone.0305263.
- [7] M. Al-Karni, M. Omar, N. Al-Dhwayan, D. Ajarim, M. Idreess, and R. Gwada, "Factors Associated with Health-Related Quality of Life Among Breast Cancer Survivors in Saudi Arabia: Cross-Sectional Study," *Asian Pac J Cancer Prev*, vol. 25, no. 3, pp. 951–961, Mar. 2024, doi: 10.31557/APJCP.2024.25.3.951.
- [8] G. A. Jassim and D. L. Whitford, "Quality of life of Bahraini women with breast cancer: a cross sectional study," *BMC Cancer*, vol. 13, no. 1, p. 212, Apr. 2013, doi: 10.1186/1471-2407-13-212.
- [9] R. Ismaili et al., "The Impact of Socioeconomic Determinants on the Quality of Life of Moroccan Breast Cancer Survivors Diagnosed Two Years Earlier at the National Institute of Oncology in Rabat," *Obstetrics and Gynecology International*, vol. 2021, no. 1, p. 9920007, 2021, doi: 10.1155/2021/9920007.
- [10] N. T. N. Ngo et al., "Health-related quality of life in breast cancer patients in low-and-middle-income countries in Asia: a systematic review," *Front. Glob. Womens Health*, vol. 4, Jun. 2023, doi: 10.3389/fgwh.2023.1180383.

[COT2-9] Artificial intelligence-driven computational biochemistry for advanced cancer drug discovery

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1. Introduction

The development of new drugs remains a major challenge, particularly for cancer and especially hormone-dependent breast cancer, which is often complicated by tumor heterogeneity and treatment resistance. In addition, drug discovery is a long, expensive, and high-failure process that can take many years before clinical application.

In this context, artificial intelligence (AI) and molecular modeling, combined with Computer-Aided Drug Design (CADD), have become powerful tools to accelerate the identification of new therapeutic candidates. Machine learning methods, including classification, regression, and deep learning, help analyze large chemical datasets, predict biological activity, and reveal complex structure–activity relationships.

The integration of supervised and unsupervised learning approaches improves prediction accuracy while reducing time and cost in the drug development process. These strategies are therefore increasingly used to support anticancer drug discovery, particularly for hormone-dependent breast cancer. In this work, we have applied these methods to predict improved drug candidates for experimental testing.

2. Materials and Methods

An integrated in silico framework was developed combining ligand-based and structure-based drug design approaches supported by AI methodologies.

A dataset of experimentally validated aromatase inhibitors was collected and standardized by converting IC₅₀ values into pIC₅₀. Molecular structures were optimized using MM2 molecular mechanics and Density Functional Theory (DFT) calculations to generate structural, electronic, and energetic descriptors.

The computational workflow was organized into three categories of AI methods:

Supervised learning approaches: Multiple Linear Regression (MLR) and Partial Least Squares (PLS) were used to develop classical QSAR and 3D-QSAR models (CoMFA and CoMSIA), establishing quantitative relationships between molecular descriptors and biological activity.

Deep learning approach: Artificial Neural Network-based QSAR (ANN-QSAR) models, implemented as multilayer neural architectures, were applied to capture nonlinear structure–activity relationships and improve predictive accuracy beyond linear statistical models.

Unsupervised learning approaches: Principal Component Analysis (PCA) was used for dimensionality reduction and descriptor exploration, while K-means clustering was applied to classify compounds and ensure a representative division into training and test sets.

Model robustness was evaluated using internal validation (Q^2), external validation (R^2_{pred}), Y-randomization tests, and applicability domain analysis. Molecular docking studies were performed using the crystal structure of aromatase, followed by 100 ns Molecular Dynamics (MD) simulations to assess stability and dynamic behavior of ligand–protein complexes. ADMET prediction was carried out to evaluate pharmacokinetic and toxicity profiles.

3. Results



The integrated AI-CADD framework demonstrated high predictive performance and strong reliability for virtual screening. Among 3D-QSAR models, CoMFA showed limited statistical robustness and was excluded. In contrast, the CoMSIA model combining steric, electrostatic, and hydrogen-bond donor fields provided the best predictive performance, with high Q^2 and R^2 values, low standard error of estimation, significant Fisher statistics, and successful Y-randomization tests. These results confirmed model robustness and excluded chance correlation.

The ANN-QSAR model further improved predictive accuracy by capturing complex nonlinear relationships between molecular descriptors and biological activity. The strong agreement between experimental and predicted pIC_{50} values confirmed excellent generalization ability. Applicability domain analysis (Williams plot) demonstrated that all compounds were within the reliable prediction space, ensuring the statistical validity of the model.

Based on CoMSIA contour map interpretation, five new candidate molecules were designed. Virtual screening indicated that all designed compounds exhibited improved predicted anticancer activity and acceptable drug-likeness properties. However, only three candidates satisfied all selection criteria within the applicability domain and were retained for further evaluation, with one emerging as the most promising molecule.

Molecular docking results revealed that this lead candidate exhibited stronger binding affinity toward aromatase compared with both the most active experimental compound and the reference inhibitor (Exemestane). The binding mode showed multiple stabilizing interactions, including hydrophobic contacts and electrostatic/electron-donor interactions with key active-site residues, suggesting improved molecular recognition and potential inhibition efficiency.

Molecular dynamics simulations confirmed the structural stability of the ligand-protein complexes. The lead complex reached equilibrium rapidly (approximately 10 ns) and remained stable throughout the 100 ns simulation, while the reference complex required a significantly longer stabilization time (around 60 ns). RMSD values remained below 3 Å, indicating stable conformational behavior. RMSF analysis confirmed limited fluctuations in key binding residues, supporting the persistence of critical interactions. Energetic analysis further indicated stronger binding stability for the selected candidate compared with the reference drug.

ADMET predictions supported the favorable pharmacokinetic profiles of the selected compounds. The lead candidate exhibited good absorption, low toxicity risk, and acceptable metabolic properties. In contrast, although the most active experimental molecule showed strong biological activity, it also presented potential toxicity concerns, emphasizing the importance of integrating AI-driven approaches to ensure the identification of safe drug candidates for experimental validation.

5. Conclusion

This study demonstrates the effectiveness of integrating AI techniques (MLR, PLS, ANN, PCA, K-means) with molecular modeling approaches for the discovery of novel aromatase inhibitors. The ANN-QSAR models provided robust and accurate predictions, while docking and molecular dynamics confirmed strong binding affinity and structural stability.

Among the designed molecules, the best candidate emerged from the final selection of three compounds, demonstrating superior predicted activity, stable receptor interactions, and favorable pharmacokinetic and toxicity profiles. These results highlight the strong potential of AI-assisted CADD workflows to accelerate drug discovery and improve the reliability of preclinical candidate selection prior to experimental validation.

References: Said El Rhabori et al , Integrative computational strategy for anticancer drug discovery: QSAR-ANN modeling, molecular docking, ADMET prediction, molecular dynamics and MM-PBSA simulations, and retrosynthetic analysis, New J. Chem., 2025,49, 14748-14768. Doi: <https://doi.org/10.1039/D5NJ02417J>

Keywords: AI; Computational biochemistry; Cancer; Drug



[COT2-10] Longitudinal symptom evolution across three time points in Locally Advanced Breast Cancer

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1. Introduction

Breast Cancer mortality rates have demonstrated a global decline across all clinical stages (Nordenskjöld et al., 2019). Notably among patients with LABC, who have a potentially curable cancer if local control is achieved (Aebi et al., 2022). This type of BC is treated using a multimodal therapeutic, integrating neoadjuvant chemotherapy (anthracyclines and taxanes), followed by surgery, adjuvant radiation therapy, and targeted therapies depending on the tumor subtype (Aebi et al., 2022).

However, despite the advances in treatment, it is associated with a significant physical suffering and severe psychiatric comorbidities (Cai et al., 2022). Ces symptômes persistants et non soulagés nuisent considérablement à la qualité de vie des survivantes de cancer de sein et peuvent entraîner des retards de traitement et une non-observance, ce qui a un impact négatif sur la survie (Fitzgerald et al., 2015; Kim et al., 2024; Reilly et al., 2013; Shim et al., 2020; Zhu et al., 2020). Tout aussi important, la cooccurrence de ces symptômes entraîne une augmentation de la détresse chez ces patientes (Esther Kim et al., 2009; Omari et al., 2023). Us well us the evaluation and management of these symptoms is becoming an increasingly important consideration. (Lee & Newman, 2007).

Few recent studies have examined the progression of symptoms in women with LABC, from diagnosis through the various phases of treatment. To our knowledge, none have adopted a

multidimensional approach involving mixed-methods analysis of this stage of cancer at three key points in the disease course. To address this knowledge gap, we opted for a longitudinal study aimed at examining the progression of physical and psychological symptoms in patients with LABC eligible for neoadjuvant chemotherapy and surgery, followed at the University Hospital Center of Fez, Morocco, as well as the sociodemographic determinants associated with this progression. This was done at three key time points in the disease: T0 at the time of diagnosis, T1 at the end of neoadjuvant chemotherapy, and T3 after surgery.

2. Materials and Methods

This study was conducted between 2019 and 2023 and followed up until March 2025, in the public oncology hospital located in the city of Fez, Morocco, until the postoperative phase. We have included female patients who were aged 18 years or older, with histologically confirmed LABC, without metastases, and eligible for NAC followed by surgery were included in the study; patients with other malignant tumors or psychiatric diseases were excluded from the study.

Initially, 203 patients with advanced breast cancer (ABC) were enrolled; however, 39 patients were excluded from the T1 assessment, leaving a total of 164 patients evaluated at T1. Of these, 17 were excluded from the T2 assessment,

and 147 patients were evaluated at T2. Participants completed a questionnaire in person in a consultation room to ensure their privacy. The questionnaire included a section on sociodemographic data and items from the MSAS scale.

The tool used is Memorial Symptom Assessment Scale (MSAS). The MSAS developed and validated by Portenoy et al. (1994), is a multidimensional self-report instrument that assesses the frequency, severity, and distress of common symptoms experienced by patients with cancer. It includes three main subscales: PSYCH-MSAS (psychological symptoms), PHYS-MSAS (physical symptoms), and the Global Distress Index (GDI), which reflects overall symptom burden based on selected psychological and physical symptoms. In this study, mixed-effects linear models were performed using R software to analyze repeated measures and identify significant predictors.

3. Results and Discussion

The average age of the 203 participants in our study at the time of diagnosis was 48.36 ± 9.70 years, with the most affected age group being from 40 to 54 years (38.3%). 59.1% of participants in this study were categorized as T4, while 40.9% were categorized as T2 or T3. Additionally, 61.1% had positive lymph node status.

All MSAS scores (psychological, physical, global distress and total) increased significantly between T0 and T1 ($p < 0.001$). This reflects a massive increase in the overall burden of symptoms due to treatment toxicity (Lotfi-Jam et al., 2019; Spichiger et al., 2011). Following surgery (T2), psychological symptoms decreased significantly in comparison with the baseline ($\beta = -0.255$; 95% CI $[-0.398, -0.112]$; $p < 0.001$). This finding indicates that emotional adjustment or psychological relief may ensue following tumour resection (Lotfi-Jam et al., 2019). This result is an indication of the patient's progressive mental resilience once the surgical phase is complete, despite the difficulty of the treatment journey.

Multivariate analysis indicates that younger age ($\beta = -0.010$, $p = 0.044$) is associated with a higher risk, likely due to significant disruptions in social, family and professional roles. A targeted psychosocial support programme is required to help these younger working women remain in the workforce, as they face specific vulnerabilities (Gokmen et al., 2025). Finally, advanced lymph node involvement emerges as a major predictor of the severity of physical symptoms and overall distress ($\beta = 0.181$, $p = 0.020$) and physical symptoms ($\beta = 0.151$, $p = 0.013$). (Lotfi-Jam et al., 2019)

5. Conclusion

While psychological distress subsides after an initial peak, physical symptoms persist over the long term. Targeted support is necessary, particularly for young patients or those with lymph node involvement.

Keywords: Locally Advanced Breast Cancer, MSAS scores, Psychological symptom, Physical symptom

References

- Aebi, S., Karlsson, P., & Wapnir, I. L. (2022). Locally advanced breast cancer. *The Breast*, Proceedings of the 17th St. Gallen International Breast Cancer Conference, 62, S58–S62. <https://doi.org/10.1016/j.breast.2021.12.011>
- Cai, T., Huang, Y., Huang, Q., Xia, H., & Yuan, C. (2022). Symptom trajectories in patients with breast cancer: An integrative review. *International Journal of Nursing Sciences*, 9(1), 120–128. <https://doi.org/10.1016/j.ijnss.2021.12.011>
- Esther Kim, J.-E., Dodd, M. J., Aouizerat, B. E., Jahan, T., & Miaskowski, C. (2009). A Review of the Prevalence and Impact of Multiple Symptoms in Oncology Patients. *Journal of Pain and Symptom Management*, 37(4), 715–736. <https://doi.org/10.1016/j.jpainsymman.2008.04.018>
- Fitzgerald, P., Lo, C., Li, M., Gagliese, L., Zimmermann, C., & Rodin, G. (2015). The relationship between depression and physical symptom burden in advanced cancer. *BMJ Supportive & Palliative Care*, 5(4), 381–388. <https://doi.org/10.1136/bmjspcare-2012-000380>
- Gokmen, I., Divriklioglu, D., Ozcan, E., Cakici, V., Coskun, A., Demir, N., & Topaloglu, S. (2025). Comprehensive Mapping of Psychosocial Burden in Breast Cancer: A Multicenter Cross-Sectional Study in Türkiye. *Namik Kemal Medical Journal*, 13(3), 231–245. <https://doi.org/10.4274/nkmj.galenos.2025.35492>

- Kim, Y. B., Lee, I. J., Byun, H. K., Choi, Y. Y., Hong, B., & Lee, J. (2024). Symptom network and quality of life of breast cancer patients receiving multimodal cancer treatment: Cross-sectional study. *European Journal of Oncology Nursing*, 71. <https://doi.org/10.1016/j.ejon.2024.102661>
- Lee, M. C., & Newman, L. A. (2007). Management of Patients with Locally Advanced Breast Cancer. *Surgical Clinics of North America, Breast Cancer*, 87(2), 379–398. <https://doi.org/10.1016/j.suc.2007.01.012>
- Lotfi-Jam, K., Gough, K., Schofield, P., Aranda, S., & Jefford, M. (2019). A longitudinal study of four unique trajectories of psychological distress in cancer survivors after completing potentially curative treatment. *Acta Oncologica*, 58(5), 782–789. 5th European Cancer Rehabilitation and Survivorship Symposium (ECRS). <https://doi.org/10.1080/0284186X.2018.1562209>
- Nordenskjöld, A. E., Fohlin, H., Arnesson, L. G., Einbeigi, Z., Holmberg, E., Albertsson, P., & Karlsson, P. (2019). Breast cancer survival trends in different stages and age groups – a population-based study 1989–2013. *Acta Oncologica*, 58(1), 45–51. <https://doi.org/10.1080/0284186X.2018.1532601>
- Omari, M., Amaadour, L., Zarrouq, B., Al-Sheikh, Y. A., El Asri, A., Kriya, S., Nadi, S., Benbrahim, Z., Mellas, N., Rhazi, K. E., Ragala, M. E. A., Hilaly, J. E., Giesy, J. P., Aboul-Soud, M. A. M., & Halim, K. (2023). Evaluation of psychological distress is essential for patients with locally advanced breast cancer prior to neoadjuvant chemotherapy: Baseline findings from cohort study. *BMC Women's Health*, 23(1), Article 1. <https://doi.org/10.1186/s12905-023-02571-1>
- Portenoy, R. K., Thaler, H. T., Kornblith, A. B., Lepore, J. M., Friedlander-Klar, H., Kiyasu, E., Sobel, K., Coyle, N., Kemeny, N., & Norton, L. (1994). The Memorial Symptom Assessment Scale: An instrument for the evaluation of symptom prevalence, characteristics and distress. *European Journal of Cancer*, 30(9), 1326–1336.
- Reilly, C. M., Bruner, D. W., Mitchell, S. A., Minasian, L. M., Basch, E., Dueck, A. C., Cella, D., & Reeve, B. B. (2013). A literature synthesis of symptom prevalence and severity in persons receiving active cancer treatment. *Supportive Care in Cancer*, 21(6), 1525–1550. <https://doi.org/10.1007/s00520-012-1688-0>
- Satin, J. R., Linden, W., & Phillips, M. J. (2009). Depression as a predictor of disease progression and mortality in cancer patients: A Meta-Analysis. *Cancer*, 115(22), 5349–5361. <https://doi.org/10.1002/cncr.24561>
- Shim, E.-J., Lee, J. W., Cho, J., Jung, H. K., Kim, N. H., Lee, J. E., Min, J., Noh, W. C., Park, S.-H., & Kim, Y. S. (2020). Association of depression and anxiety disorder with the risk of mortality in breast cancer: A National Health Insurance Service study in Korea. *Breast Cancer Research and Treatment*, 179(2), 491–498. <https://doi.org/10.1007/s10549-019-05479-3>
- Spichiger, E., Mueller-Froehlich, C., Denhaerynck, K., Stoll, H., Hantikainen, V., & Dodd, M. (2011). Prevalence of symptoms, with a focus on fatigue, and changes of symptoms over three months in outpatients receiving cancer chemotherapy. *Swiss Medical Weekly*, 141, w13303. <https://doi.org/10.4414/smw.2011.13303>
- Zhu, G., Li, J., Li, J., Wang, X., Dai, M., & Chen, J. (2020). Depression and survival of breast cancer patients. *Medicine*, 99(48), e23399. <https://doi.org/10.1097/MD.00000000000023399>

[COT2-11] Coping strategies and treatment response in Moroccan women with locally advanced breast cancer

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1. Introduction

Breast cancer is the most common cancer among women worldwide. In Morocco, as in many developing countries, its incidence has risen significantly in recent years, accounting for 38.8% of new cancer cases and causing 4,044 deaths among women in 2022. Notably, 35.5% of Moroccan patients are diagnosed at an advanced stage, for which neoadjuvant chemotherapy (NACT) is the recommended treatment approach. In this context, pathological complete response (pCR) serves as a surrogate marker for disease-free survival and overall survival. Specifically, pCR is defined as the absence of both invasive and in situ residual disease in the breast and lymph nodes, and represents the strongest predictor of favorable outcomes. Beyond its physical burden, BC and its treatment constitute a major ordeal for both body and mind. Indeed, patients undergoing NACT frequently experience high levels of depression and anxiety. Faced with these challenges, women diagnosed with BC employ a variety of coping strategies to manage the physical and psychological demands of the disease. The aim of the present study is therefore to explore the impact of coping strategies on pCR in Moroccan patients with locally advanced breast cancer (LABC).

2. Materials and Methods

Between 2019 and 2023, a prospective study was conducted in which 203 women diagnosed with LABC were recruited at their first oncology consultation. Eligible patients were aged 18 years or older, had confirmed BC without metastases, and were selected to receive NACT. All participants provided written informed consent before enrollment. Exclusion criteria included the presence of other malignant tumors and pre-existing psychiatric illnesses.

Of the 203 patients initially recruited, 31 were subsequently excluded from surgical follow-up for various reasons: refusal of surgery (n = 3), death during NACT (n = 5), loss to follow-up (n = 5), or disease progression during NACT (n = 18). This resulted in a final cohort of 172 patients who underwent surgery. Among these, 55 women (32%) achieved a pCR, while 117 (68%) had an incomplete response.

In addition to sociodemographic and clinical variables, mental coping was assessed using the Arabic version of the Mini-Mental Adjustment to Cancer Scale (Mini-MAC). Qualitative variables, corresponding to sociodemographic and clinical characteristics, were described using frequencies and percentages. For quantitative variables, namely coping strategies, the mean and standard deviation (SD) were calculated. Univariate and multivariate logistic regression analyses were performed to identify factors associated with pathological response (complete versus incomplete). Both sociodemographic and clinical characteristics, as well as positive and negative coping strategies, were included in the regression model.

3. Results



The mean age at diagnosis was 48.36 years (SD = 9.70), with most participants aged between 40 and 54 years old. The majority were married (70.79%) and had children (88.51%). Regarding clinical characteristics, invasive ductal carcinoma was the predominant histological type (95.57%). More than half of patients presented with T4 tumors (59.11%), consistent with locally advanced disease. The luminal subtype (ER+ and/or PR+, HER2-) was the most frequent molecular subtype (42.86%). Most patients were diagnosed at an advanced stage (stages IIIB or IIIC: 60.1%), with a notable proportion presenting high-grade tumors (grade 3: 29.64%).

Analysis of coping strategies revealed that fatalism was the most frequently employed strategy (3.87 ± 0.37), followed by the fighting spirit strategy. Overall, positive coping was predominant (3.55 ± 0.48). Multivariate logistic regression identified negative coping as significantly associated with a reduced likelihood of achieving pCR (adjusted OR = 0.47; 95% CI: 0.24–0.86). Molecular subtype was also independently associated with pCR: the ER+/PR+, HER2+ subtype (adjusted OR = 6.26; 95% CI: 2.03–21.36), the HER2-enriched subtype (ER-, PR-, HER2+; adjusted OR = 43.39; 95% CI: 10.85–210.12), and the triple-negative subtype (adjusted OR = 9.80; 95% CI: 3.14–34.84) were all significantly associated with pCR

4. Discussion

This prospective study investigated the influence of coping strategies, alongside sociodemographic and clinical factors, on pCR in Moroccan women with LABC undergoing NACT. Fatalism emerged as the predominant coping strategy, consistent with findings from previous studies conducted in Morocco and other Muslim-majority populations. This approach reflects patients' tendency to accept their diagnosis as an inevitable reality, grounded in personal reasoning and religious faith, which may facilitate psychological adjustment throughout the disease course. From a clinical perspective, molecular subtype and disease stage were significantly associated with pCR, corroborating well-established evidence in the literature. HER2-positive and triple-negative subtypes are recognized predictive factors for pCR, and advanced stages (II–III) have been shown to benefit most from neoadjuvant therapy in terms of response rates.

Regarding coping strategies, our results revealed that negative coping was associated with a reduced likelihood of achieving pCR. To our knowledge, no prior study has specifically examined the relationship between coping strategies and pCR following NACT, which limits direct comparison with the existing literature. Earlier systematic reviews have reported no consistent association between psychological coping and cancer outcomes overall, though methodological limitations constrained those conclusions.

These findings suggest that exploring the psychosocial dimensions of treatment response represents a novel and clinically relevant avenue, with potential implications for supportive care interventions aimed at optimizing pathological outcomes in breast cancer patients.

5. Conclusion

Understanding the psychological and clinical factors that influence pCR after NAC in patients with BC highlights the importance of a multidisciplinary approach to managing these patients, which integrates biological and psychosocial factors.

Keywords: Mental adjustment, locally advanced breast cancer, Pathological complete response, Morocco



[COT2-13] Prognostic value of initial psychological distress in Moroccan breast cancer patients: metastasis-free survival and overall survival at three years

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1. Introduction

Breast cancer represents a major public health issue in Morocco because of its frequency and its clinical, social, psychological, and quality-of-life consequences. Among patients with locally advanced breast cancer (LABC), the period preceding neoadjuvant chemotherapy (NACT) is particularly critical. It combines the announcement of the diagnosis, prognostic uncertainty, waiting for treatment initiation, and a substantial emotional burden.

Psychological distress, particularly depression and anxiety, is common among patients with breast cancer. It may influence quality of life, adjustment to illness, treatment adherence, and healthcare utilization. In Morocco, available studies have mainly described the frequency of psychological distress, its associated factors, and the psychological adjustment strategies used by patients before neoadjuvant chemotherapy. However, an important gap remains in the Moroccan context. Limited data are available on the prognostic value of initial psychological distress. In particular, the association between depression or anxiety measured before neoadjuvant chemotherapy and objective prognostic outcomes, such as metastasis-free survival and overall survival, remains insufficiently documented. This gap limits the integration of psychological assessment into clinical risk stratification and comprehensive patient care. In this context, this analysis aimed to assess the association between depression and anxiety measured at baseline and two 3-year survival outcomes: metastasis-free survival (MFS) and overall survival (OS), among Moroccan women with breast cancer who were candidates for neoadjuvant chemotherapy.

2. Materials and Methods

A survival analysis was conducted using a cohort of women with newly diagnosed LABC who were candidates for NACT. Patients were recruited before the initiation of systemic treatment, allowing baseline psychological assessment before exposure to NACT. Patients with metastatic disease at baseline were excluded when this information was available. Data were collected using a structured questionnaire administered at inclusion. The collected information included sociodemographic characteristics, clinical and tumor-related data, treatment-related characteristics, and psychological variables measured before the start of neoadjuvant chemotherapy. Depression and anxiety were assessed using the Arabic version of the Hospital Anxiety and Depression Scale (HADS). Scores were categorized into two groups: normal status for scores from 0 to 7, and borderline/abnormal status for scores from 8 to 21. The two main exposure variables were baseline depression and baseline anxiety. They were analyzed separately to assess their respective associations with survival outcomes. The outcomes were 3-year metastasis-free survival (MFS) and 3-year overall survival (OS). Survival times were expressed in months. Events were coded as binary variables, with 1 indicating event occurrence and 0 indicating censored observations. Survival probabilities at 12, 24, and 36 months were estimated using the Kaplan-

Meier method, overall and according to baseline depression and anxiety status. Group comparisons were performed using the log-rank test. Univariable Cox models were then used to estimate crude hazard ratios (HRs) and their 95% confidence intervals. Variables associated with the outcomes at $p < 0.20$ in univariable analysis were considered candidates for adjusted models. Multivariable Cox models were built separately for MFS and OS, and separately for depression and anxiety. The main exposure variable was forced into each model regardless of statistical significance. Candidate covariates were selected using a backward procedure based on the likelihood ratio test. Results were presented as adjusted hazard ratios (aHRs), with 95% confidence intervals and p-values. The proportional hazards assumption was assessed using Schoenfeld residuals. Analyses were performed using R software. Ethics approval was obtained for this cohort study by the hospital university ethics committee (N°24/18) associated to University of Sidi Mohamed Ben Abdellah.

3. Results

A total of 203 patients were included in the main survival analyses. Among them, 83 patients (40.9%) had a normal depression score, whereas 120 patients (59.1%) had borderline/abnormal depression at baseline. Regarding anxiety, 74 patients (36.5%) had a normal score, while 129 patients (63.5%) had borderline/abnormal anxiety at baseline. These results show that a high proportion of patients had initial psychological distress before treatment. The overall Kaplan-Meier estimated metastasis-free survival was 92% at 12 months, 79% at 24 months, and 70% at 36 months. Overall survival was higher, with an estimated OS of 97% at 12 months, 89% at 24 months, and 82% at 36 months. Kaplan-Meier analyses showed poorer survival among patients with borderline/abnormal depression or anxiety at baseline. For MFS, 36-month survival was 78% among patients with normal depression status, compared with 65% among those with borderline/abnormal depression. Similarly, 36-month MFS was 79% among patients with normal anxiety status, compared with 65% among those with borderline/abnormal anxiety. For OS, 36-month survival was also lower among patients with initial psychological distress. It was 88% among patients without depression compared with 78% among those with borderline/abnormal depression. For anxiety, 36-month OS was 87% in the normal group compared with 78% in the borderline/abnormal group. In univariable Cox analysis, borderline/abnormal depression at baseline was significantly associated with an increased risk of metastasis (HR = 1.77; 95% CI: 1.02–3.10; $p = 0.044$). Borderline/abnormal anxiety was also significantly associated with an increased risk of metastasis (HR = 1.88; 95% CI: 1.04–3.39; $p = 0.036$). For OS, the associations were in the same direction but were not statistically significant, HR = 1.86 for depression (95% CI: 0.89–3.87; $p = 0.098$) and HR = 1.76 for anxiety (95% CI: 0.83–3.76; $p = 0.143$). After adjustment, borderline/abnormal anxiety at baseline remained significantly associated with poorer MFS, with an aHR of 2.24 (95% CI: 1.14–4.41; $p = 0.013$). Borderline/abnormal depression also showed an unfavorable trend for MFS, with an aHR of 1.81 (95% CI: 0.96–3.40; $p = 0.059$), without reaching the conventional threshold for statistical significance. Complete pathological response was associated with better MFS in both adjusted models. For OS, borderline/abnormal depression was associated with an increased risk of death, with an aHR of 2.70 (95% CI: 0.87–8.37; $p = 0.065$), but the association remained at the limit of statistical significance. Borderline/abnormal anxiety also showed an unfavorable trend, with an aHR of 2.12 (95% CI: 0.67–6.74; $p = 0.180$), without statistical significance. Urban residence was associated with better overall survival in the adjusted models.

4. Discussion

The findings suggest that baseline psychological distress, particularly anxiety, may be associated with poorer metastasis-free survival among women with breast cancer treated with neoadjuvant chemotherapy. Borderline/abnormal anxiety remained significantly associated with an increased risk of metastasis after adjustment, while depression showed a similar but limit association.

These results indicate that anxiety before treatment may reflect a broader vulnerability, involving psychosocial, behavioral, and possibly biological dimensions. Potential mechanisms include poorer coping, sleep disturbance, fatigue, altered health behaviors, reduced adherence to care, and stress-related inflammatory or immune pathways. However, because of the observational design, no causal interpretation can be made. The association with overall survival was

weaker. Although the adjusted hazard ratios for depression and anxiety were greater than 1, the associations were not statistically significant, probably due to the limited number of death events at 3 years.

Overall, the consistency between Kaplan-Meier estimates, univariable Cox models, and adjusted Cox models supports the relevance of early psychological assessment. Screening for anxiety and depression before neoadjuvant chemotherapy may help identify patients who require closer psychosocial and clinical follow-up.

5. Conclusion

This analysis shows that a high proportion of Moroccan women with breast cancer had initial psychological distress before neoadjuvant chemotherapy. Borderline/abnormal anxiety measured at baseline was significantly associated with a higher risk of metastasis at 3 years after adjustment. For OS, the associations observed with depression and anxiety were in the same direction but were not statistically significant. These findings support the integration of early psychological assessment into the care pathway of patients with breast cancer, particularly before neoadjuvant chemotherapy. Further studies with larger sample sizes and longer follow-up are needed to confirm these associations and to better understand the mechanisms linking initial psychological distress, cancer adjustment, and clinical prognosis.

Keywords: Psychological distress, locally advanced breast cancer, metastasis-free survival, overall survival.

[COT2-14] Women’s Satisfaction with Early Cervical Cancer Screening in Health Centers in Salé: A Descriptive Cross-Sectional Study

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1. Introduction

Cervical cancer remains a major public health problem worldwide and in Morocco. Yet it is largely preventable through effective interventions, including HPV vaccination, HPV testing, and visual inspection with acetic acid (VIA) [1]. The effectiveness of screening programmes depends not only on service availability, but also on the quality of implementation. In this regard, users’ satisfaction is an essential indicator of quality of care, encompassing reception, communication, perceived provider competence, accessibility, respect for privacy, and comfort during the examination [2–7].

Participation in screening is influenced by several sociodemographic, psychological, and organisational factors. Lack of information, fear of the result, embarrassment, discomfort, the provider’s gender, and the absence of clear recommendations from healthcare professionals may limit women’s adherence to screening [4,8–12]. In Morocco, despite the objectives of the National Cancer Prevention and Control Plan, annual screening coverage remains low, estimated at less than 10% of the target population, while only 14.4% of women had ever been screened according to the 2018 National Population and Family Health Survey [10–13]. Assessing the satisfaction of screened women may therefore help identify key levers for improving the programme. This study aimed to assess women’s satisfaction with early cervical cancer screening by VIA in health centers in the prefecture of Salé, and to describe their knowledge, perceptions, and main difficulties encountered throughout the screening pathway.

2. Materials and Methods

A descriptive cross-sectional study was conducted in ten health centers in the prefecture of Salé. The centers were selected by simple random sampling and represented approximately one third of the prefecture’s health centers. The study population consisted of 300 women aged 30–49 years who had undergone early cervical cancer screening by VIA. Data were collected between October 2023 and April 2024.

Data were gathered using a questionnaire developed from the literature [14]. It covered participants’ sociodemographic characteristics, knowledge of cervical cancer and the screening programme, perception of the examination, and satisfaction with different dimensions of the service. The questionnaire was prepared in French, translated into Arabic, and pretested with ten women. Data analysis was performed using Jamovi, version 2.3.28. The protocol was approved by the Biomedical Research Ethics Committee of Rabat (CERB 38-24).

3. Results

More than three quarters of the participants had an educational level ranging from primary school to higher education. More than 90% had undergone only one VIA screening visit, across all age groups, suggesting mainly opportunistic recruitment rather than organised and regular follow-up.

Regarding overall satisfaction, 80.0% of women reported being satisfied with the competencies of healthcare providers. However, only 31.7% were aware of the cervical cancer screening programme, with radio and television being the main source of information (83.0%). Fear of being diagnosed with cervical cancer was a source of anxiety for 96.0% of participants.

Relational and organisational dimensions appeared less favorable. In the examination room, 50.0% of women were satisfied with the kindness of the reception, while 55.0% reported being dissatisfied with staff listening and availability. In

addition, 75.3% were dissatisfied with the conduct of the VIA test, and 87.0% considered the examination uncomfortable. Feeling cold during the examination was the most frequently reported complaint after screening.

Continuity of care also appeared insufficient: 99.0% of participants reported that the provider had not informed them of the date of the next visit. Among women with a positive VIA result, most (92.5%) stated that they had to book the referral appointment at the reproductive health reference center themselves. Despite these shortcomings, 99.0% of participants said they would recommend the VIA test to people around them.

4. Discussion

The findings reveal a contrast between relatively high satisfaction with the perceived technical competencies of providers and substantial dissatisfaction with the relational, organisational, and experiential dimensions of screening. In an intimate and potentially anxiety-provoking examination, quality of reception, listening, empathy, counseling, discretion, and respect for physical comfort are crucial to reducing apprehension and promoting adherence to the programme.

The limited awareness of the national programme suggests that community sensitisation and counseling within health facilities remain insufficient. This finding is consistent with the literature linking low participation in cervical cancer screening to lack of information, negative perceptions of the examination, and the absence of active recommendation by healthcare providers [4,13,14]. Furthermore, mainly opportunistic recruitment and the absence of a clearly documented appointment system may weaken continuity of care, particularly for women with a positive result.

5. Conclusion

This study highlights the need to strengthen the overall quality of early cervical cancer screening in health centers in Salé. Beyond providers' technical competence, improvements are needed in information provision, reception, listening, comfort during the examination, and follow-up of screened women. Strengthening communication strategies, training providers in counseling, improving the conditions under which VIA is performed, and implementing a structured appointment and referral system could enhance women's satisfaction and adherence to the screening programme.

Keywords: cervical cancer; early screening; VIA; satisfaction; women; Morocco.

References

1. World Health Organization. Global strategy to accelerate the elimination of cervical cancer as a public health problem. WHO; 2022.
2. Arbyn M, Anttila A, Jordan J, Ronco G, Schenck U, Segnan N, et al. European Guidelines for Quality Assurance in Cervical Cancer Screening. *Ann Oncol*. 2010;21(3):448–458.
3. Tsegaye K, Hagos A, Kindie H, Minyihun A, Teshale G. Evaluation of cervical cancer screening program in Gondar city administration public health facilities. *BMC Cancer*. 2023;23:1034.
4. Diendéré J, Kiemtoré S, Coulibaly A, Tougri G, Ily NI, Kouanda S. Low attendance in cervical cancer screening. *Rev Epidemiol Sante Publique*. 2023;71(4):101845.
5. Moukhafi S. Conceptualisation de la satisfaction des patients dans les établissements de santé. *Revue Française d'Economie et de Gestion*. 2023;4(5).
6. Benchekroun S, Taouab O, Abdelbaki N. Déterminants de la satisfaction des bénéficiaires des services de soins de santé. *Revue Internationale des Sciences de Gestion*. 2023;6(3).
7. Yameogo AR, Millogo GRC, Palm AF, et al. Évaluation de la satisfaction des patients dans le service de cardiologie du CHU Yalgado Ouedraogo. *Pan Afr Med J*. 2017;28:267.
8. Duchange N, Poiseuil M, Rollet Q, et al. How do women comply with cancer screenings? *BMC Womens Health*. 2023;23:190.
9. Ishii K, Tabuchi T, Iso H. Combined patterns of participation in cancer screenings among women in Japan. *Prev Med*. 2021;150:106627.
10. Ministère de la Santé. Programme de dépistage des cancers du sein et du col de l'utérus du Maroc: état de la mise en œuvre, organisation et résultats. 2019.
11. Belglaiaa E, Mougín C. Cervical cancer: current situation and management in Morocco. *Bull Cancer*. 2019;106(11):1008–1022.
12. Ministère de la Santé. Enquête nationale sur la population et la santé familiale 2018: rapport préliminaire. 2019.



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14. Selmouni F, Zidouh A, Alvarez-Plaza C, El Rhazi K. Perception and satisfaction of cervical cancer screening by VIA in Meknes-Tafilalet, Morocco. *BMC Women's Health.* 2015;15:106.



[COT2-16] Prevention of Cervical Cancer: Knowledge, Attitudes, and Practices among Health Professionals in Primary Health Care Facilities in Taza Province

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1. Introduction

Cervical cancer remains a major public health problem. According to GLOBOCAN 2022, it is the fourth most common cancer among women worldwide, the sixth in the Eastern Mediterranean Region, and the second most common cancer among women in Morocco after breast cancer, with an estimated 2,644 new cases in 2022 [1]. In the Fes-Meknes region, it also ranks second according to the 2017 hospital-based cancer registry of Hassan II University Hospital in Fes, with a frequency of 12.28% [2]. Cervical cancer is associated with substantial morbidity and mortality, as well as high treatment costs [3,4].

Cervical cancer most often results from persistent infection with high-risk human papillomavirus (HPV) [5]. Because its etiology is well established, this cancer is largely preventable through two complementary interventions: HPV vaccination and early screening for precancerous cervical lesions [6].

In Morocco, cervical cancer prevention is a priority of the National Cancer Prevention and Control Plan 2020-2029 [7] and the National Sexual and Reproductive Health Strategy 2021-2030 [8]. However, current program performance remains below the expected targets. In 2023, participation in the cervical cancer early detection program reached 5.3% at the national level and 8% in Taza Province, compared with a target of 25% [9]. In 2024, HPV vaccination coverage among 11-year-old girls in Taza Province was 23.1%, far from the target of 90%.

In this context, assessing the knowledge, attitudes, and practices (KAP) of health professionals working in primary health care facilities (PHCFs) can help identify capacity-building needs and key levers for improving the cervical cancer prevention program. The objective of this study was to assess the knowledge, attitudes, and practices related to cervical cancer prevention among health professionals working in PHCFs in Taza Province, and to identify factors associated with the overall KAP score.

2. Materials and Methods

This was a quantitative cross-sectional study with descriptive and analytical aims, conducted from April 2 to May 16, 2025. The study exhaustively targeted the 314 health professionals working in the 74 PHCFs of Taza Province who agreed to participate [11].

Data were collected using a self-administered online questionnaire developed with Google Forms. The questionnaire comprised four sections: sociodemographic and professional characteristics, knowledge, attitudes, and practices related to cervical cancer prevention.

Knowledge, attitudes, and practices were assessed using scores converted into percentages. Knowledge was classified into four levels: poor (<50% correct answers), insufficient (50 to <65%), average (65 to <85%), and good ($\geq 85\%$). Attitudes were classified as harmful (<50%), incorrect (50 to <65%), approximate (65 to <85%), and appropriate ($\geq 85\%$). Practices were classified as harmful (<50%), inadequate (50 to <85%), and adequate ($\geq 85\%$) [10,12].

Statistical analysis was performed using Jamovi version 2.3.28. The analysis included descriptive statistics for participant characteristics and KAP scores, followed by multivariable logistic regression to identify factors associated with the overall KAP score.

3. Results

A total of 211 health professionals participated in the study, corresponding to a response rate of 67.2%. The mean age of participants was 34.5 ± 9.5 years, and 40.8% were aged 30 to 39 years. The sample was predominantly female

(79.6%), with a male-to-female sex ratio of 0.26. Married participants accounted for 64.9% of the sample. Professionally, polyvalent nurses were the most represented category (59.7%). Urban health centers level 1 were the most frequent workplace setting (30.8%). More than one third of participants (41.7%) had more than 10 years of professional experience. Almost all participants (96.7%) reported having received initial training on cervical cancer prevention. However, only 38.9% had received continuing training on HPV vaccination, and 39.8% had received continuing training on early cervical cancer screening.

The overall knowledge score ranged from 0 to 13, with a mean of 8.5 ± 1.97 . Approximately half of the health professionals (51.7%) had an average level of knowledge, whereas 44.6% had an insufficient or poor level. Only a small minority (3.8%) had a good level of knowledge. The overall attitude score ranged from 9 to 16, with a mean of 14.6 ± 1.49 . Nearly all participants had positive attitudes, classified as approximate or appropriate (98.6%). Incorrect attitudes were observed in only 1.4% of participants, and no harmful attitudes were identified. The overall practice score ranged from 7 to 35, with a mean of 23.0 ± 6.95 . More than half of the participants (52.1%) had inadequate practices. Adequate practices were reported among 23.2% of health professionals, while 24.6% had harmful practices. The overall KAP score was average in 52.6% of participants, insufficient in 27.0%, good in 17.1%, and poor in 3.3%. Multivariable logistic regression showed that a more favorable overall KAP score was significantly associated with being female ($p = 0.031$), having 6 to 10 years of professional experience ($p = 0.018$) or more than 10 years of experience ($p = 0.010$), compared with less than 2 years of experience, and having received continuing training on HPV vaccination ($p = 0.009$) and cervical cancer screening ($p = 0.032$). Conversely, the overall KAP score was significantly less favorable among older professionals ($p = 0.015$), divorced participants compared with single participants ($p = 0.012$), polyvalent nurses ($p = 0.002$), and family and community health nurses ($p = 0.011$), compared with midwives.

4. Discussion

This study highlights a marked contrast between generally favorable attitudes toward cervical cancer prevention and still insufficient levels of knowledge and practices among a substantial proportion of health professionals. This finding is particularly important in a context where PHCF professionals play a central role in health education, referral, HPV vaccination, and early screening.

These results are consistent with several studies that have assessed health professionals' KAP regarding cervical cancer prevention, particularly early screening, and have emphasized the need to strengthen continuing education programs [12,13,14,15,16,17,18,19]. Differences between studies may be explained by geographical, temporal, and population-related variations, as well as by the lack of a standardized scale for measuring KAP related to cervical cancer prevention.

The positive association between continuing training and the overall KAP score underscores the importance of implementing regular, practical, and targeted training programs. Such training should address HPV vaccination, early screening, communication with women and parents, and the operational procedures for implementing the program at the PHCF level.

5. Conclusion

Health professionals working in PHCFs in Taza Province generally showed favorable attitudes toward cervical cancer prevention. However, their knowledge and, above all, their practices remain improvable. The overall KAP score was associated with several sociodemographic and professional factors, including sex, professional experience, professional category, and participation in continuing training. These findings support the strengthening of continuing training, supervision, and practical support for health professionals in the field of cervical cancer prevention. Such a strategy could contribute to improving adherence to early screening and HPV vaccination, in line with national objectives for the elimination of cervical cancer.

Keywords: cervical cancer; HPV; screening; vaccination; knowledge, attitudes, and practices; health professionals; primary health care; Morocco.

References



1. International Agency for Research on Cancer. GLOBOCAN 2022: Morocco fact sheet. Available from: <https://gco.iarc.who.int/media/globocan/factsheets/populations/504-morocco-fact-sheet.pdf>
2. Hospital-based Cancer Registry of Hassan II University Hospital of Fes, 2017. Power BI Report. Available from: <https://app.powerbi.com/view?r=eyJrJmJc2ZjAzOWEtMjM1OC00NzdkLTliNzktYWYWM2OTM0ZjlxYjMwliwidCI6IjE4ZmZiZjNhLWNjNGUtNDE3MS1iYjA3LWJIMTcyYjE3ODQxNyIsImMiOj9>
3. Arveux P, Bénard S, Bouée S, Lafuma A, Martin L, Cravello L, et al. Invasive cervical cancer treatment costs in France. *Bull Cancer*. 2007;94(2):219-224.
4. Berraho M, Najdi A, Mathoulin-Pelissier S, Salamon R, Nejari C. Direct costs of cervical cancer management in Morocco. *Asian Pac J Cancer Prev*. 2012;13(7):3159-3163. doi:10.7314/apjcp.2012.13.7.3159
5. Bhatla N, Aoki D, Sharma DN, Sankaranarayanan R. Cancer of the cervix uteri: 2021 update. *Int J Gynaecol Obstet*. 2021;155(Suppl 1):28-44. doi:10.1002/ijgo.13865
6. Zhang J, Ke Y, Chen C, Jiang Z, Liu H, Liu Y, et al. HPV cancer burden by anatomical site, country, and region in 2022. *Sci Rep*. 2025;15(1):21048. doi:10.1038/s41598-025-06700-8
7. Ministry of Health. National Cancer Prevention and Control Plan 2020-2029. Available from: https://www.sante.gov.ma/Documents/2021/03/Plan_National_de_Prevention_et_de_Controlle_du_Cancer_2020-2029_VF.pdf
8. Ministry of Health. National Sexual and Reproductive Health Strategy 2021-2030. Available from: <https://www.sante.gov.ma/Documents/2023/04/SNSSR%202021-2030.pdf>
9. Ministry of Health and Social Protection. Health in Figures 2023. Available from: <https://www.sante.gov.ma/Documents/2025/01/Sante%20en%20chiffre%202023%20VF.pdf>
10. Essi MJ, Njoya O. The KAP survey in medical research. *Health Sciences and Disease*. 2013;14(2). doi:10.5281/hsd.v14i2.183
11. Ministry of Health and Social Protection. Health Map: Health care services. Available from: https://cartesanitaire.sante.gov.ma/dashboard/pages2/rh_med_2024.html
12. Obossou AAA, Aboubakar M, Ogoudjobi M, Atade SR, Vodouhe MV, Sidi RI, et al. Knowledge, attitudes and practices regarding cervical cancer among health professionals in Parakou, Benin, in 2016. *European Scientific Journal*. 2021;17(25):290-290. doi:10.19044/esj.2021.v17n25p290
13. Obossou, A. A. A.; Sidi, R. I.; Klipézo, R.; Pognon, M.-C. B.; Bakari, S.; Atade, S. R.; Vodouhe, M. V.; Yehouessi, K. F.; Ahouingnan, F. M. N. H.; Salifou, K. Connaissances, Attitudes et Pratiques Des Professionnels de Santé En Matière de Cancer Du Col de l'utérus Dans La Commune de Parakou (Bénin) En 2024. *Eur. Sci. J. ESJ* 2025, 21 (18), 134–134. <https://doi.org/10.19044/esj.2025.v21n18p134>.
14. Nani, S.; Hassoune, S.; Benallal, M.; Kissi, D.; Maaroufi, A. Knowledge by physicians concerning cervical cancer and testing: Benimellal province, Morocco. *East. Mediterr. Health J*. 2018, 24 (12), 1135–1145. <https://doi.org/10.26719/2018.24.12.1135>.
15. A, N.; N, B.; S, E. F.; N, T.; M, B.; Yc, K.; L, B.; L, A.; R, B.; C, N. Awareness of Cervical Cancer Risk Factors, Screening Practices and Attitudes among Nurses in a Primary Health Care Setting of Morocco: A Cross-Sectional Study. *J. Cancer Sci. Clin. Oncol*. 2016, 3 (2), 1. <https://doi.org/10.15744/2394-6520.3.203>.
16. Fakhfakh, R. Connaissances et Participation Des Médecins et Sages-Femmes de Première Ligne Vis-à-Vis Du Dépistage Des Cancers Du Col Utérin et Du Sein.
17. Marie Tebeu P, Antaon JSS, Adjeba M, Pikop F, Fouogue JT, Ndom P. Connaissances, attitudes et pratiques des professionnels de santé sur le cancer du col de l'utérus au Cameroun. *Santé Publique*. 2020;32(5):489-96.
18. Berraho M, Fakir SE, Abda N, Mathoulin-Pelissier S, Nejari C. Connaissances et pratiques des médecins vis-à-vis du cancer du col de l'utérus et de l'infection HPV à Fès. *Santé Publique*. 6 août 2013;25(3):351-7.
19. ReBéMI, Ayélo Ap., Mikponhoué R., Saké K., Jg. M, Faladé Mp., et al. CONNAISSANCE DES PROFESSIONNELS DE LA SANTÉ SUR LES CANCERS DU SEIN ET DU COL UTÉRIN À PARAKOU EN 2021. *Rev Béninoise Mal Infect [Internet]*. 23 oct 2024 [cité 11 mars 2025];2(1). Disponible sur: <https://soumission.infectiologiebenin.bj/index.php/recc/article/view/5>



THEME 3 : EPIDEMIOLOGY OF VECTOR-BORNE DISEASES

[COT3-1] Morphometric Polymorphism in *Galba truncatula* (Mollusca: Lymnaeidae), Vector of *Fasciola hepatica* (Trematoda) in Livestock

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1. Introduction

Fasciolosis is a parasitic disease caused by the liver fluke *Fasciola hepatica*, a trematode well recognized for its high veterinary impact and of increasing importance in human health worldwide (Mas-Coma et al., 2009). Its transmission is obligatorily mediated by freshwater snails of the family Lymnaeidae, most notably *Galba truncatula* (Müller, 1774), the obligate intermediate host. The parasite develops from miracidium through sporocyst and rediae stages inside the snail, before releasing cercariae that encyst on vegetation as infective metacercariae for the definitive host.

Galba truncatula is a small-shelled freshwater snail with a broad global distribution, reported across Europe, Africa, the Americas, and parts of Asia (Vázquez et al., 2018). Its remarkable ecological plasticity and wide habitat tolerance allow it to establish populations across a range of environments, thereby facilitating the worldwide expansion of fasciolosis (Vázquez et al., 2018). Lymnaeids also exhibit considerable phenotypic variability in shell morphology despite close anatomical similarity among species, making morphometric analysis an essential preliminary step before molecular characterization (Vázquez et al., 2018).

The primary objective of this study is to analyze the polymorphism in *Galba truncatula* and its potential impact on the transmission of *Fasciola hepatica* in the Tensift basin (Marrakech-Safi region, Morocco), through two specific objectives: (1) analyze morphometric differences using geometric and traditional morphometric techniques across five populations; and (2) assess the incidence of *F. hepatica* in livestock in the study area.

2. Materials and Methods

The study area is the Tensift basin, a semi-arid hydrological unit covering 20,450 km² in central-western Morocco, encompassing the High Atlas Mountains, the Haouz plain, and the Jbilet range (Zamrane, 2016). Five *G. truncatula* populations were examined: three field-collected populations (Lmrah, n=32; Targa, n=30; El Attaouia OGG4, n=24) and two populations sorted from the archived gastropod collection of the Natural History Museum of Marrakech (MNHM) (Ben Smim, n=17; Oued Bazza, n=26), yielding a total of N=129 shells. *Fasciola hepatica* specimens were collected from the livers of slaughtered ruminants in two rural abattoirs of El Haouz, under the supervision of ONSSA, Marrakech-Safi region.

Shell images were acquired with a GRIPHAX stereomicroscopic camera under standardized conditions. For geometric morphometrics, 32 landmarks were digitized per shell using TpsUtil and TpsDig: nine biologically homologous landmarks (apex, whorl sutures, aperture extremities) and 23 semi-landmarks along the shell outline. After Generalized Procrustes Analysis, Canonical Variate Analysis (CVA) and thin-plate spline diagrams were performed in MorphoJ. For traditional morphometrics, six shell measurements were recorded (SH, SW, AH, AW, BWH, SpH) and four conchometric ratios calculated (SH/SW, AH/AW, SpH/BWH, BWH/SW), then analyzed by PCA in PAST and one-way ANOVA with Tukey's b-test in SPSS.

3. Results

CVA showed that the first two canonical variates explained 71.8% of total shape variation (CV1 = 47.90%; CV2 = 23.90%). The scatter plot revealed clear inter-population morphological differentiation: Ben Smim was positioned centrally on CV1 while Lmrah occupied the positive CV1 side, indicating significant shape divergence between these two populations. Oued Bazza, El Attaouia OGG4, and Targa showed considerable overlap, suggesting morphological affinity among these field populations. Thin-plate spline diagrams indicated that CV1 captures variation in the apex and body whorl regions (shell elongation), while CV2 reflects differences in aperture size.

Traditional morphometrics revealed that PC1 and PC2 accounted for 90.173% of total variance (PC1 = 58.401%; PC2 = 31.772%). The strong negative position of Ben Smim and the positive position of Lmrah on PC1 confirmed robust inter-population discrimination, driven mainly by the ratios SH/SW, SpH/BWH, and BWH/SW. One-way ANOVA confirmed highly significant inter-population differences for SH/SW ($F(4,124) = 24.582$, $p < 0.001$), SpH/BWH ($F(4,124) = 22.642$, $p < 0.001$) and BWH/SW ($F(4,124) = 7.625$, $p < 0.001$), and a moderately significant result for AH/AW ($F(4,124) = 2.772$, $p = 0.03$). Tukey's b-test showed that Ben Smim differed significantly from all Tensift basin populations for SH/SW, while populations within the Tensift basin showed strong internal homogeneity.

Macroscopic examination of adult *F. hepatica* specimens collected from El Haouz slaughterhouses confirmed active parasite transmission in the study area, with flukes displaying the characteristic leaf-shaped body, prominent suckers, and bilateral intestinal branching consistent with *Fasciola hepatica*.

4. Discussion

Both morphometric approaches converged in identifying Ben Smim as the most morphologically divergent population. This divergence is likely attributable to contrasting environmental conditions between the Ben Smim collection site and the Tensift basin populations, possibly compounded by genetic drift in geographically isolated localities. The homogeneity observed among the three contemporary Tensift basin populations (Lmrah, El Attaouia OGG4, Targa) in SH/SW and BWH/SW ratios suggests that shared environmental and possibly genetic factors within the same hydrological unit exert a unifying influence on shell shape.

From an epidemiological perspective, the morphometric divergence observed among *G. truncatula* populations may reflect underlying genetic diversity with direct consequences for parasite-host compatibility particularly regarding local adaptation dynamics between the parasite and its snail host *F. hepatica* infection (Correa et al., 2017). Such population-level variation opens promising avenues for AI-driven classification and spatial risk modelling of *G. truncatula* distribution, with potential applications in vector surveillance and fasciolosis control (Roessler et al., 2022).

5. Conclusion

This study confirms significant morphometric differences between five *G. truncatula* populations in the Tensift basin, most pronounced between the archived Ben Smim population and the contemporary Lmrah field population. These differences are likely attributable to contrasting environmental conditions and possible genetic drift between geographically distinct collection sites. Active fasciolosis transmission was confirmed in El Haouz livestock slaughterhouses, underscoring the epidemiological relevance of local vector diversity. Further polymorphism analysis particularly molecular tests targeting DNA markers such as ITS-2 rDNA (Bargues et al., 2001) is necessary to confirm these morphological distinctions, determine intraspecific genetic interpopulational variability, and assess the vectorial capacity and susceptibility of *G. truncatula* populations to *F. hepatica* in Morocco.

Keywords: *Galba truncatula*; *Fasciola hepatica*; geometric morphometrics; traditional morphometrics; polymorphism; fasciolosis; Tensift basin; Morocco

References



Bargues, M. D., Vigo, M., Horak, P., Dvorak, J., Patzner, R. A., Pointier, J. P., Jackiewicz, M., Meier-Brook, C., & Mas-Coma, S. (2001). European Lymnaeidae (Mollusca: Gastropoda), intermediate hosts of trematodiasis, based on nuclear ribosomal DNA ITS-2 sequences. *Infection, Genetics and Evolution*, 1(2), 85–107. [https://doi.org/10.1016/s1567-1348\(01\)00019-3](https://doi.org/10.1016/s1567-1348(01)00019-3)

Correa, A. C., De Meeûs, T., Dreyfuss, G., Rondelaud, D., & Hurtrez-Boussès, S. (2017). *Galba truncatula* and *Fasciola hepatica*: Genetic costructures and interactions with intermediate host dispersal. *Infection, Genetics and Evolution*, 55, 186–194. <https://doi.org/10.1016/j.meegid.2017.09.006>

Mas-Coma, S., Valero, M. A., & Bargues, M. D. (2009). *Fasciola*, lymnaeids and human fascioliasis, with a global overview on disease transmission, epidemiology, evolutionary genetics, molecular epidemiology and control. *Advances in Parasitology*, 69, 41–146. [https://doi.org/10.1016/S0065-308X\(09\)69002-3](https://doi.org/10.1016/S0065-308X(09)69002-3)

Roessler, A. S., Oehm, A. W., Knubben-Schweizer, G., & Groll, A. (2022). A machine learning approach for modelling the occurrence of *Galba truncatula* as the major intermediate host for *Fasciola hepatica* in Switzerland. *Preventive Veterinary Medicine*, 200, 105569. <https://doi.org/10.1016/j.prevetmed.2022.105569>

Vázquez, A. A., Alda, P., Lounnas, M., Sabourin, E., Alba, A., Pointier, J. P., & Hurtrez-Boussès, S. (2018). Lymnaeid snails hosts of *Fasciola hepatica* and *Fasciola gigantica* (Trematoda: Digenea): a worldwide review. *CAB Reviews*, 13(062), 1–15. <https://doi.org/10.1079/PAVSNNR201813062>

Zamrane, Z. (2016). Recherche d'indices de variabilité climatique dans des séries hydroclimatiques au Maroc. Doctoral thesis, Université Montpellier. <https://theses.hal.science/tel-01690063>

[COT3-2] Fascioliasis in Central-Northern Regions of Morocco: Ecology, Vector Distribution, and Epidemiological Implications

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1. Introduction

Parasitic diseases are infections caused by parasites living organisms that derive energy from another organism called a host (Combes, 2018). Among neglected tropical parasitic diseases, fascioliasis is a topic of growing interest from both medical and veterinary perspectives (WHO, 2017).

This disease is caused by hermaphroditic Digenetidae species such as *Fasciola hepatica* (Chen and Mott, 1990), commonly known as the “giant liver fluke.” This parasite is characterized by a complex life cycle involving definitive hosts usually ruminants and, occasionally, humans and an intermediate host: *Galba truncatula* (Muller, 1774). The latter is a freshwater gastropod mollusk of the family Lymnaeidae Rafinesque, 1815 (Rondelaud 1983; Knubben-Schweizer & Torgerson 2015).

The transmission of fascioliasis is closely linked to the presence of this mollusk. Adult *Fasciola* spp. parasites live in the bile ducts of the liver of several mammals, but the larvae must pass through intermediate host mollusks before establishing themselves in a new definitive host (humans or ruminants). Domestic animals are usually the most heavily infested; however, it is worth noting that some small mammal species (particularly rodents) can play an important role as reservoirs for the parasite in the wild (Ménard et al., 2000; 2001).

Risk factors for this parasitic disease are directly linked to the ecology of its transmission vector, *G. truncatula*, a mollusk living in freshwater. Vegetation, which can play various roles in the transmission cycle of fascioliasis, can be used as an indicator of the presence of gastropods of the Limnaeidae family (Rondelaud et al., 2011).

According to the World Health Organization (WHO), fascioliasis is a significant public health problem. The WHO estimates that, in 2017, 2.4 million people were infected in approximately 70 countries worldwide (WHO, 2017), including Morocco. Despite this situation, no research has been conducted to study this problem in Morocco or in the Fez region.

2. Materials and Methods

Fieldwork was conducted between 2024 and 2025 using a simple qualitative random sampling method. The specimens were then stored in labeled glass vials, preserved in alcohol, and transported to the laboratory. At the same time, several physicochemical parameters of the water (temperature, pH, conductivity, and salinity) were measured using a multiparameter analyzer after the values had stabilized.

In the laboratory, the samples were washed, sorted, and examined in Petri dishes. The mollusks were grouped according to their morphological characteristics and then identified at the family, genus, and species levels using a binocular magnifying glass, with reference to the works of MOUTHON (1982), the WHO (1982), and Daniel (2011). Specimens from the family Lymnaeidae, particularly *Galba truncatula*, were isolated individually and subjected to biometric measurements of the shell according to the model by Cuezco (2020), in order to assess population variability.

Finally, after identifying and counting the species, several ecological parameters were calculated: population size, relative abundance, and frequency of occurrence. These indicators made it possible to characterize the structure of the malacological communities, assess their diversity, and better understand the distribution of species in the studied habitats.

3. Results



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We collected 2,061 freshwater gastropod specimens belonging to eight families, ten genera, and thirteen species. The gastropods are predominantly represented by the genus *Melanopsis*, although the family *Lymnaeidae* is also present with two genera, *Galba* and *Radix*. The genus *Galba* is represented by a single species: *G. truncatula*.

G. truncatula is a species of low abundance (1% of the fauna) and low frequency (23% occurrence rate). A morphological analysis of the collected specimens reveals homogeneity in terms of size but slight variability in shape, particularly at the shell aperture. Our ecological observations show that the measured physicochemical parameters of the water are not related to the presence or absence of this vector. The distribution of *G. truncatula* is linked to the biotope or microhabitat.



[COT3-3] Fasciolosis in the Moroccan Middle Atlas region: Current status, challenges and research perspectives.

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1. Introduction

Fasciolosis, also known as liver fluke disease or hepatic distomatosis, is a vector-borne parasitic disease affecting herbivorous mammals, particularly domestic ruminants. It is caused by trematodes of the genus *Fasciola*, mainly *Fasciola hepatica* in temperate regions and *Fasciola gigantica* in tropical areas.

Fasciolosis, one of the most widely distributed helminthic diseases of livestock, is responsible for major economic losses estimated at more than 3 billion US dollars per year, with more than 600 million animals potentially infected. (Cwiklinski et al., 2016; Hayward et al., 2021)

In Morocco, the available evidence mainly points to the circulation of *F. hepatica*, with *Galba truncatula* acting as the main intermediate host. Transmission appears to be localised and seasonal. The prevalence of infected animals may reach 50%, with two peaks of parasite burden during autumn and winter. Despite their scientific and economic importance, these data remain limited and outdated, as they come from studies carried out between 1985 and 1988. (Khallaayoune et al., 1991)

The present work contributes to updating current knowledge on animal fasciolosis in the Moroccan Middle Atlas. It aims to assess the current prevalence of the disease, describe its local spatial distribution, explore potential risk factors and improve understanding of the ecological conditions involved in the persistence of the transmission cycle.

2. Materials and Methods

The study adopts an integrated approach combining field malacological surveys, ecological characterization of wetland habitats, abattoir-based investigations, and when available, the recovery of adult flukes for morphological identification and complementary analyses.

A preliminary malacological study was conducted at five wetland sites within the study area: Lake Zarrouka, Lake Timahdite, Lake Tizi N'Tafoucht, Lake Tifounassin, and the Guigou wadi. These sites offer a diversity of aquatic and semi-aquatic habitats favorable to freshwater molluscs. We sampled and identified 576 mollusc specimens, including 28 individuals identified as *Galba truncatula* (4.9% of the total sample).

3. Results and Discussion

The distribution of *G. truncatula* varied markedly among sampling sites. The highest proportion was observed at Tizi N'Tafoucht, where 21 specimens were found among 126 collected molluscs, corresponding to 16.7%. Lower proportions were found at Lac Zarrouka, with 4 specimens out of 192 molluscs, representing approximately 2.1%, and at Timahdite, with 3 specimens out of 152 molluscs representing 2.0%. No *G. truncatula* individuals were detected at Oued Guigou or Lac Tifounassin during this preliminary survey.

These preliminary findings confirm the presence of *G. truncatula* in certain favourable biotopes within the study area. They also show that the distribution of the intermediate host is not uniform, but rather concentrated in specific microhabitats. The high proportion observed at Tizi N'Tafoucht suggests that this site may represent a priority area for further investigation. In particular, it should be targeted for seasonal follow-up of snail populations, ecological characterization of the habitat and screening for natural infection by larval stages of *F. hepatica*.

The presence of *G. truncatula* alone does not necessarily confirm active transmission of fasciolosis. However, it represents a key environmental indicator, since the development of the parasite depends on the availability of suitable snail hosts. The detection of this species in several wetland sites supports the hypothesis that local ecological conditions may still be conducive to the maintenance of the transmission cycle. These findings reinforce the need for an integrated approach combining malacological, environmental and animal-level data.

In parallel with the field malacological surveys, abattoir-based investigations are currently being conducted in Timahdite, Azrou, Meknes, Fez and other slaughtering points receiving animals originating from the study area. We aim to estimate the apparent prevalence of fasciolosis at slaughter, document liver lesions compatible with liver fluke infection, quantify liver condemnations, and assess the economic losses associated with the disease. Whenever possible, adult flukes are recovered from affected livers for morphological identification and further complementary analyses.

The abattoir component is central to the integrated design of the study, as it allows the ecological risk observed in the field to be confronted with direct evidence of infection in slaughtered animals. By comparing the presence and abundance of *G. truncatula* in wetland habitats with the slaughterhouse findings including liver lesions and fluke recovery, the study will help determine whether favourable environmental conditions are associated with the active circulation of *F. hepatica* in livestock. This combined approach is expected to support the identification of high-risk areas, inform evidence-based decision-making and contribute to the design of surveillance, prevention and control strategies that are better adapted to local livestock production systems and environmental realities.

Keywords: Fasciolosis; *Galba truncatula*; *Fasciola hepatica*; Middle Atlas; Morocco



[COT3-4] Freshwater molluscs of medical interest in Fez-Sefrou region, Morocco

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1. Introduction

The medical significance of freshwater molluscs lies in their role as intermediate hosts for parasites that cause diseases such as schistosomiasis and fascioliasis, which affect millions of people worldwide. The World Health Organization (WHO) estimates that at least 93.6% of people in need of treatment for schistosomiasis live in Africa, particularly in the poorest communities, and that at least 253.7 million people required preventive treatment for schistosomiasis in 2024 (WHO, 2026), and at least 2.4 million people living in more than 70 countries are infected with fascioliasis (WHO, 2021).

In Morocco, urinary schistosomiasis, caused by *Schistosoma haematobium* and transmitted by *Bulinus truncatus*, was first diagnosed in 1914 in Marrakesh and remained endemic until 1981 (Amarir et al., 2014). A national schistosomiasis control program, launched in 1982, aimed to eliminate transmission of the disease by 2004. This goal was achieved, as prevalence reached zero indigenous cases in 2004 (Balahbib et al., 2020). Given the current context of climate change and human and animal migration, an update on the status of vector populations which serve as indicators of transmission risk is essential.

The first malacological study conducted in the Fez and Sefrou regions resulted in the collection and identification of nearly 3,000 freshwater mollusks from 26 sites. The study aimed to assess the diversity, distribution, and ecology of the species, particularly those that transmit parasitic diseases.

2. Materials and Methods

Between April and June 2024, a malacological survey was conducted at 13 freshwater wetland sites in the Fez-Meknes region using the transect method. Molluscs were collected through qualitative sampling, preserved in 96% ethyl alcohol, and accompanied by field data. The physicochemical parameters of the water (temperature, pH, conductivity, salinity, TDS, and resistivity) were measured in situ. In the laboratory, the specimens were sorted, identified using morphological characteristics and reference taxonomic keys, and then counted. The data were then analyzed using several ecological indices, including relative abundance, frequency of occurrence, species richness, the Shannon-Weaver diversity index, Pielou's evenness index, and the linear correlation coefficient.

3. Results

This study provided the first inventory of freshwater mollusks in the Fez and Sefrou regions, identifying 13 of the 40 species known in Morocco and revealing a marked decline in malacological biodiversity. Gastropods largely dominate the recorded fauna. The absence of *Bulinus truncatus*, an intermediate host for schistosomiasis, may be linked to ecological, climatic, and anthropogenic factors. In contrast, *Galba truncatula*, a vector for fasciolosis, as well as *Melanopsis praemorsa*, a dominant species and potential vector for several trematodes, were observed. Two invasive species, *Physella acuta* and *Corbicula* sp., were also recorded. Finally, *Melanopsis praemorsa* shows a weak correlation with physicochemical parameters, with only salinity exhibiting a significant negative correlation.

5. Conclusion

Only 13 species of freshwater mollusks were recorded in Fez and Sefrou, revealing a significant decline in malacological biodiversity. The absence of *Bulinus truncatus* and the low abundance of *Galba truncatula* could be linked to the dominance of *Melanopsis praemorsa*, the presence of invasive species (*Physella acuta* and *Corbicula* sp.), as well as climate change and water management projects.



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[COT3-6] Proliferation of Mosquitoes (Diptera, Culicidae) that Transmit Infectious Diseases in Northeastern Morocco

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1. Introduction:

Vector-borne diseases constitute a major public health problem both nationally and internationally. Mosquitoes (Culicidae) are responsible for several vector-borne diseases such as malaria, dengue, Zika, chikungunya, and West Nile virus. A total of 23 mosquito species are recognized in Morocco as potential vectors for the transmission of pathogens (Trari et al., 2017). The presence of specific genera such as Aedes, Anopheles, or Culex determines the type of risk. In Morocco, although indigenous malaria was eradicated several decades ago, surveillance of mosquito-borne diseases remains a priority due to the risk of re-emergence and the introduction of new diseases. Among arboviral diseases of medical concern, West Nile virus has been regularly detected in mosquitoes and certain animal hosts, indicating viral circulation in the country. Other arboviral diseases, such as Rift Valley fever, also pose a potential threat. These mosquitoes have specific periods of activity. Their diversity requires particular attention to their identification and distribution. Ecological factors can contribute to disease transmission. Monitoring the proliferation of Culicidae is a crucial step toward improving the effectiveness of vector control management.

2. Objective:

The objective of this study is to assess the diversity, abundance, and distribution of disease-transmitting Culicidae species within the study area, as well as to characterize the ecological parameters of the associated larval habitats.

3. Methods:

Field research was conducted in Fez between November 2015 and December 2016. Surveys were conducted every two months at twenty-seven breeding sites, including 12 watercourses, 7 springs, 2 fountains, 3 marshes, 1 lake, 1 dam reservoir, and 1 water reservoir. The dynamics and biotopology of Culicidae species were assessed every two weeks at four representative habitats: a dam, a river, a marsh, and a spring. Mosquito larvae were sampled using the “dipping” method in shallow habitats (Service, 1976). In deep habitats, larvae were collected using a bucket 30 cm in diameter, attached to a rope (El Joubari et al., 2014). The physicochemical parameters of the various biotopes were measured, and the characteristics of the macrohabitats were recorded. Mosquito larvae were identified using an OPTIKA optical microscope, the Moroccan identification key for Culicidae (Himmi et al., 1995), and identification software for mosquitoes of Mediterranean Africa (Bruhnes et al., 1999). Plants and algal species were identified using field guides. The data obtained were analyzed using ecological indices of composition (Bouabida et al., 2012) and structure. Statistical analyses were performed using R software, version 3.4.3 (2017), to study the biological typology of Culicidae species using a generalized linear model (GLM) and to assess the relationships between abiotic and biotic factors and the abundance of the most common species. Factor analyses were conducted to better understand the correlation between environmental factors and the bioecological characteristics of each species.

4. Results:

A total of 1531 Culicidae larvae were collected from the various breeding sites surveyed, revealing the presence of 11 species belonging to two subfamilies (Culicinae and Anophelinae) and five genera (Anopheles, Culex, Culiseta, Aedes, and Uranotaenia). The major vectors of malaria (*Anopheles maculipennis* s. l. and *Anopheles sergentii*) and the primary vectors of West Nile virus (*Culex pipiens*, *Culex theileri*, and *Culex perexiguus*) were collected. *Culex pipiens* is by far the most abundant species (pi: 70.68%), the most widespread (C: 48.15%), and the most frequently recorded (F: 19.44%); it was present throughout the study period, and its distribution is diverse and adapted to almost all habitats. Its density was high in temporary, deep, and turbid habitats rich in ions and dissolved solids and characterized by high temperatures and a rather basic pH, whereas it was low in more oxygenated, saline, and naturally occurring environments. Oxygenated aquatic environments rich in vegetation and characterized by high pH and salinity values may facilitate faster development of *Culex theileri* larvae. The abundance of *Culex perexiguus* highlights a close relationship with industrial activities, a correlation with slow-flowing aquatic environments, and the presence of algae and debris. Only the species *Culex pipiens* and *Culiseta longiareolata* were collected, even in breeding sites devoid of vegetation and fauna. Thus, disease-carrying mosquitoes of the genus *Culex* primarily the two species *Culex perexiguus* and *Culex theileri* were frequently found cohabiting with animal species of the families Nepidae, Ephemeridae, and Heptageniidae, and even in the presence of *Gambusia*, a larvivorous fish used in biological mosquito control. The species *Anopheles maculipennis* s. l. and *Anopheles sergentii* are underrepresented, with abundances of 0.53% and 1.25%, respectively. *Anopheles* species were found to dominate in three breeding sites rich in vegetation and algae, where Hydropsychidae, Tabanidae, Dytiscidae, and Chironomidae were present in abundance. Larvae of *Anopheles maculipennis* s. l. were found in two permanent habitats characterized by waters with a basic pH (ranging from 7.96 to 9.93) during March, June, and July 2016; they were scarce during the winter and were present alongside *Najas marina* and *Polypogon monspeliensis*. The species *Anopheles sergentii* was present during the cold season, represented by, in the fall and winter. It was frequently found in areas with decomposing grasses and green algae.

5. Discussion:

The species richness recorded in the Fez region reflects the entomological diversity characteristic of semi-arid Mediterranean areas and confirms the coexistence of species with high vector competence within the same geographic area. The overwhelming predominance of *Culex pipiens* (>70% of the total collection) is consistent with published data for the Mediterranean region and attests to its high ecological plasticity, enabling it to colonize both anthropized urban habitats and natural environments. Its tolerance to organic pollution and physicochemical variations makes it an even more concerning vector from an epidemiological standpoint. Although the mosquitoes *Aedes aegypti* and *Aedes albopictus* vectors of arboviruses of public health significance, such as the dengue, chikungunya, and Zika viruses were reported near Marrakech in 1996 and in Rabat in 2015, respectively, they were not detected in the study area. This absence significantly reduces the risk of local transmission of these arboviral diseases, which remains primarily associated with imported cases from endemic areas.

6. Conclusion:

Morocco is facing the emergence of vector-borne diseases, making surveillance and vector control particularly important. In this regard, this entomological study conducted in Fez between 2015 and 2016 provides an original and quantified contribution to our understanding of the Culicidae fauna of northeastern Morocco. The collection of 1531 larvae representing 11 species belonging to five genera including confirmed vectors of malaria and West Nile virus confirms the region's vector potential and justifies the maintenance of a sustainable entomological surveillance system. The predominance of *Culex pipiens* and its perfect adaptation to anthropized environments make it the priority target for vector control programs in the urban context of Fez. Ultimately, the results of this study thus provide valuable insights for managers of vector surveillance and control programs. However, it is necessary to continue and strengthen

entomological studies and surveillance activities in order to prevent the establishment of new populations of these vectors and to limit the risk of future arbovirus transmission.

Keywords: Proliferation, Culicidae, Fez, Morocco, malaria, control.



[COT3-7] Eco-Friendly Control of *Culex pipiens* Using Optimized Ternary Mixtures of Moroccan *Artemisia* Essential Oils

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1. Introduction

Mosquito-borne diseases remain a major global public health concern. *Culex pipiens*, an important vector of West Nile virus, is widely distributed in Morocco. Although synthetic insecticides remain the primary means of mosquito control, their intensive use has promoted environmental contamination, adverse effects on non-target organisms, and the emergence of insecticide resistance. Consequently, eco-friendly alternatives are urgently needed.

Essential oils (EOs) from aromatic plants are promising botanical insecticides because of their biodegradability and diverse biological activities. Species of the genus *Artemisia* are particularly rich in bioactive terpenoids with recognized insecticidal properties. Moreover, combining EOs may generate synergistic effects, leading to enhanced efficacy. This study evaluated the larvicidal activity of EOs from three Moroccan *Artemisia* species (*A. absinthium*, *A. arborescens*, and *A. campestris*) against *C. pipiens* larvae and optimized their binary and ternary mixtures using a mixture design approach.

2. Materials and Methods

Aerial parts of the three *Artemisia* species were collected during the flowering stage and subjected to hydrodistillation using a Clevenger apparatus. The extracted EOs were analyzed by GC-FID and GC-MS for chemical characterization.

Third-instar larvae of *C. pipiens* were exposed to different EO concentrations following WHO guidelines. Larval mortality was recorded after 24 h, and LC_{50} and LC_{90} values were estimated by probit analysis.

To investigate synergistic interactions, binary and ternary EO combinations were evaluated using an augmented simplex-centroid mixture design. Experimental data were analyzed with Design-Expert software to determine the optimal formulation.

3. Results and Discussion

EO yields differed among species, with *A. arborescens* producing the highest yield, followed by *A. absinthium* and *A. campestris*. GC-MS analysis showed that oxygenated monoterpenes were the dominant chemical class in all oils.

The principal constituents were thujone (32.20%), camphor (19.95%), and chamazulene (19.58%) in *A. absinthium*; thujone (52.05%), camphor (10.71%), and eucalyptol (4.79%) in *A. arborescens*; and camphor (18.98%), car-3-en-5-one (11.25%), and thujone (6.63%) in *A. campestris*.

All EOs exhibited strong larvicidal activity against *C. pipiens*. *A. arborescens* was the most active species ($LC_{50} = 11.11 \mu\text{g/mL}$), followed by *A. absinthium* ($16.98 \mu\text{g/mL}$) and *A. campestris* ($19.07 \mu\text{g/mL}$). Their high efficacy is likely related to the abundance of oxygenated monoterpenes, particularly thujone and camphor.

Mixture experiments revealed significant synergistic interactions. The binary mixture of *A. absinthium* and *A. campestris* produced 100% larval mortality, while the combination of *A. absinthium* and *A. arborescens* achieved more than 99% mortality. The quadratic model adequately fitted the experimental data ($R^2 > 0.99$). Optimization using the desirability function identified the best ternary formulation as 58% *A. absinthium*, 26% *A. arborescens*, and 16% *A. campestris*, resulting in 100% mortality of *C. pipiens* larvae.

These results demonstrate that optimized EO mixtures are more effective than individual oils and represent a promising strategy for reducing the quantity of active ingredients while maintaining high larvicidal efficacy.

4. Conclusion

Moroccan *Artemisia* essential oils possess strong larvicidal activity against *Culex pipiens*. The mixture design approach successfully identified a highly effective ternary formulation that achieved complete larval mortality through synergistic interactions among the three oils. These findings support the development of environmentally friendly botanical larvicides and provide a basis for future semi-field and field evaluations aimed at integrating these formulations into sustainable mosquito vector management programs.

Keywords: *Artemisia absinthium*; *Artemisia arborescens*; *Artemisia campestris*; Essential oils; *Culex pipiens*; Larvicidal activity; Mixture design; Botanical insecticides.

[COT3-9] Diversity and ecology of blood-feeding arthropods in poultry farms, urban forests, and a zoological garden: an integrated approach in the Rabat-Casablanca region, Morocco

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1. Introduction

Vector-borne diseases are considered one of the major health challenges, and many are circulating in moroccan territory, including leishmaniasis, bluetongue, West Nile virus... Despite this risk, knowledge regarding the diversity and distribution of vectors in certain anthropised environments remains limited, particularly in zoos, urban forests, and farms situated in the outskirts of cities. To address this, an entomological survey was conducted in Rabat-Salé-Kénitra and Casablanca-Settat regions. The objective is to assess the relative abundance and the diversity of some of the main Diptera species of medical and veterinary importance present in these environments.

2. Materials and Methods

This study comes as a follow up to previous sampling and surveillance surveys of blood-feeding arthropods carried out by the Unit of Parasitology and Parasitic Diseases of the Hassan II Institute of Agronomy and Veterinary Medicine. The sampling took place between March and September 2025 at the National Zoological Garden of Rabat (JNZR), the periurban forests of Maâmoura and Harhoura and four poultry farms located in the municipalities of Ben Slimane, Ain Aouda, and Tiflet. Two groups of Diptera were captured in the JZNR: Muscidae and Phlebotominae, since Culicoides and mosquitoes were already assessed in a previous study (Bourquia et al., 2025), as well as Culidcoides in the periurban forests and poultry farms. Three trapping devices were used: Vavoua traps for blood-sucking flies, castor oil sticky traps for sandflies, and OVI light traps for Culicoides.

Morphological identification of the specimens at the species level was done under a stereomicroscope and using reference taxonomic keys adapted to each group. No molecular screening of pathogens was conducted yet, meaning that the results show the presence, diversity, and abundance of potential vectors and do not conclude to an actual pathogen circulation.

3. Results

Muscidae represented 300 individuals distributed into nine species. *Stomoxys calcitrans* was the most dominant (92.3%), followed by *Musca crassirostris* (3,3%), a species that is reported eventually for the first time in Morocco.

A total of 45 Phlebotominae were captured, divided in six species, including *Phlebotomus perniciosus* (11,1%) and *Phlebotomus sergenti* (4,4%), two known vectors of *Leishmania* spp. in the Mediterranean basin.

In periurban forests, 182 Culicoides individuals belonging to 11 species were collected, with *C. subfagineus* (37.4%) and *C. imicola* (15.9%) being the most dominant. In poultry farms, 562 Culicoides from 10 species were captured, dominated by *C. circumscriptus* (53.7%) and *C. imicola* (20.6%).

4. Discussion and Conclusion

These results highlight the coexistence of multiple vector species in peri-urban environments, where contact between humans, livestock, and wildlife is important, creating favorable conditions for pathogen transmission. *Stomoxys calcitrans* is considered as a source of stress and nuisance to the housed animals and contributes to the mechanical transmission

of multiple pathogens. The presence of *Phlebotomus perniciosus* and *Ph. sergenti* near captive animals and zoo visitors raises high concerns regarding leishmaniasis transmission. Similarly, the detection of *Culicoides imicola*, the main vector of bluetongue virus, in different sites suggests favorable conditions to maintain transmission cycles if the virus is introduced or already circulating locally. Although the presence of a vector species alone does not validate active circulation of pathogens, it alerts to the importance of enhanced entomological surveillance and monitoring in peri-urban interfaces.

[COT3-10] Taxonomic update and epidemiological analysis of the Ixodidae tick collection from Morocco

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1. Introduction

In North Africa, ticks (Acari:Ixodida) are the most important vectors of zoonotic pathogens, transmitting a variety of bacteria, viruses, and protozoa [1]; [2]. However, our current knowledge of the historical spatial distribution of these vectors in Morocco is limited, hindering our understanding of emerging risks [2]. In Morocco, climate change and livestock migration are driving the evolution of these vectors. Historical collections constitute an essential "biological archive" that allows us to trace the history of these species and prevent emerging epidemiological threats. This study presents a taxonomic review of the collection stored at the Scientific Institute, focusing on species that directly impact human and animal health. The aim is to characterize the transmission dynamics of pathogens in Morocco more effectively.

2. Materials and Methods

Origin and Conservation of Specimens: We sampled a diverse range of specimens from various hosts including dromedaries, cattle, dogs and small ruminants. Figure 1 shows the geographic distribution of the collection sites generated via QGIS and the list of hosts is expressed as the frequency of conservation tubes.

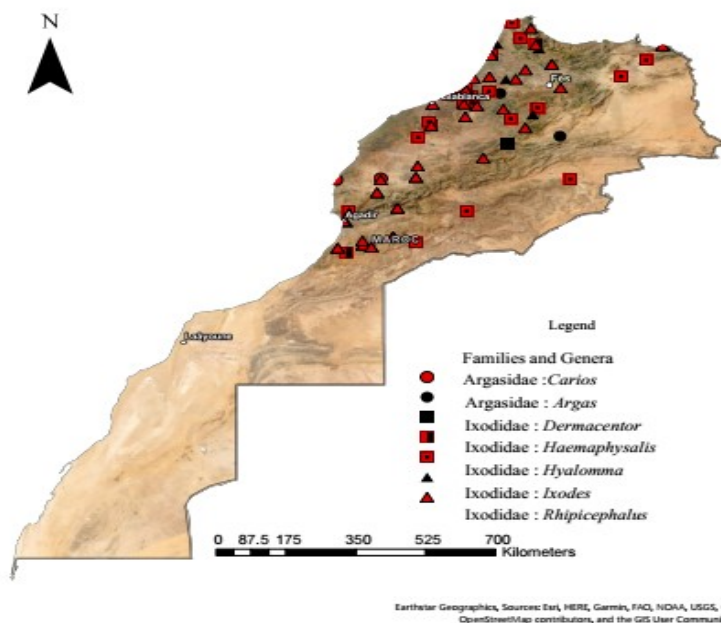


Figure 1: The geographic distribution of tick's collection sites in Morocco.

Although the number of specimens per tube varies, this unit enables us to evaluate encounter and parasitism frequencies by host species within the collection as illustrated in Figure 2.

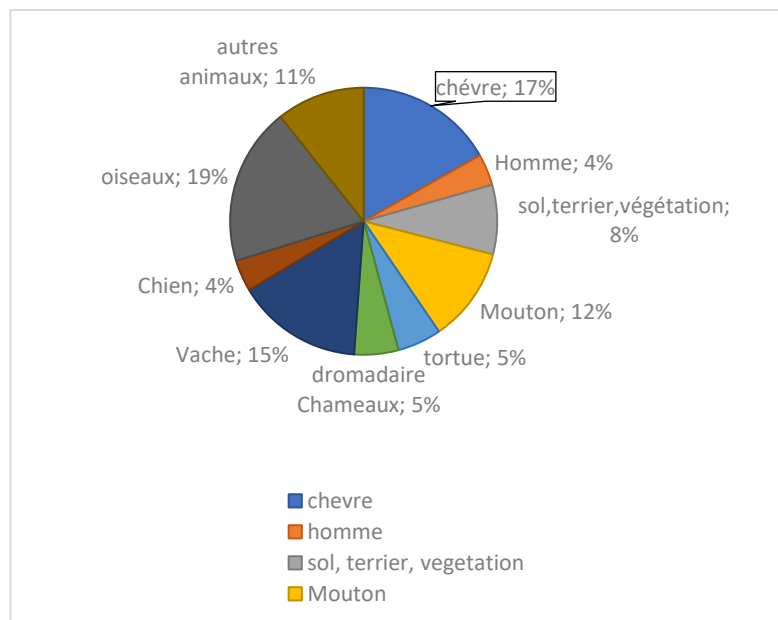


Figure 2: Parasitism frequency expressed by the number of storage tubes per host species (n = 138).

The studied collection comprises 1168 specimens, collected between 1965 and 1979, with the exception of one specimen collected in 1921. Identification was carried out exclusively through macroscopic and microscopic morphology, using a binocular microscope and reference dichotomous reference keys for North Africa [3].

The taxonomic examination of each specimen focused on essential morphological diagnostic morphological criteria, such as the shape of the capitulum base, gnathostome morphology, festoon shape and peritremal plate structure. We would like to clarify that the identification was based exclusively on morphological micro- and macroscopic characteristics, as the specimens were preserved in formalin, a substance that severely degrades DNA. [4] [5] .

3. Results:

Diversity of Vector Species of Epidemiological Interest

The inventory identified [20] species, which are distributed among seven genera. Here, we focus on species at high risk:

The Hyalomma genus: The species *H. aegyptium* and *H. marginatum* are the main vectors of the Crimean Congo haemorrhagic fever virus. This virus is an emerging threat in the Mediterranean basin[6]. This species constitutes 9% of the specimens recorded at the Scientific Institute.

Rhipicephalus genus: Notably the *Rhipicephalus sanguineus sensu lato* complex is a vector of Mediterranean spotted fever (*Rickettsia conorii*) [7], [8].. Its presence on domestic dogs in urban areas poses a significant risk to humans. This species represents 11% of the specimens stored at the scientific institute.

Ixodes genus: Identification of *Ixodes ricinus* in forest areas. It is the vector of Lyme disease and tick-borne encephalitis (Boudebouch & Sarih, 2008. It represents 0,6% of the specimens stored at the Scientific Institute.

4. Discussion

4.1 The Risk of Red Meat Allergies in Morocco

This study revisits the original question of the risk associated with the α -Gal syndrome (allergies to red meat induced by ticks). While the *Amblyomma americanum* tick is the known vector in the United States[9], studies show that species present in Morocco, such as *Ixodes ricinus* and *Rhipicephalus bursa*, possess α -gal epitopes in their saliva that can sensitise humans [10], [11] . The confirmed presence of these species in our collection suggests that this syndrome may be present in Morocco but remain undiagnosed.

4.2 Contribution of Artificial Intelligence

In the context of this congress, we emphasise that the data in this collection (historical points of presence and hosts) constitute a valuable "dataset." This dataset can be used to train machine learning models to predict the future distribution of vectors under different climate change scenarios, enabling precise epidemiological surveillance [12]

5. Conclusion

In conclusion, updating this heritage collection shows that critical vectors are still present in Morocco. Although formalin currently restricts genetic analyses, the accuracy of morphological identification enables a risk map to be created. In future, studies on new specimens preserved in ethanol will enable an integrative taxonomic approach to be taken to resolve doubts about cryptic species .In the context of increased globalisation and avian migration, Morocco is in a strategically important location, making it vulnerable to the introduction of new vectors and pathogens.[13]

References

- [1] A. Abdelbaset, M. Kwak, N. Nonaka, et R. Nakao, « Human-biting ticks and zoonotic tick-borne pathogens in North Africa: diversity, distribution, and trans-Mediterranean public health challenges », *One Health*, vol. 16, p. 100547, avr. 2023, doi: 10.1016/j.onehlt.2023.100547.
- [2] G. Matulis et al., « A compilation of ticks and tick-borne pathogen distributions in seven countries within North and West Africa from 1901 to 2022: a systematic literature review », *Parasit Vectors*, vol. 19, no 1, p. 13, déc. 2025, doi: 10.1186/s13071-025-07153-8.
- [3] A. Bouattour, M. A. Darghouth, et A. Daoud, « Distribution and ecology of ticks (Acari: Ixodidae) infesting livestock in T[unisia: an overview of eight years field collections ».
- [4] A. R. Walker, *Ticks of domestic animals in Africa: a guide to identification of species*, vol. 74. Bioscience Reports Edinburgh, 2003. Consulté le: 13 juin 2026. [En ligne]. Disponible sur: https://www.researchgate.net/profile/Ali-Bouattour/publication/294560744_Tiques_d'importance_medicale_et_veterinaire_le_bassin_mediterraneen_ICTTD_CD-ROM_Mediterraneans_ticks_3-12_12/links/5fca11ab45851568d13a9198/Tiques-dimportance-medicale-et-veterinaire-le-bassin-mediterraneen-ICTTD-CD-ROM-Mediterraneans-ticks-3-12-12.pdf
- [5] W. Mathieson et G. A. Thomas, « Why Formalin-fixed, Paraffin-embedded Biospecimens Must Be Used in Genomic Medicine: An Evidence-based Review and Conclusion », *J Histochem Cytochem*, vol. 68, no 8, p. 543-552, août 2020, doi: 10.1369/0022155420945050.
- [6] S. S. Celina, J. Černý, et A. M. Samy, « Mapping the potential distribution of the principal vector of Crimean-Congo haemorrhagic fever virus *Hyalomma marginatum* in the Old World », *PLOS Neglected Tropical Diseases*, vol. 17, no 11, p. e0010855, nov. 2023, doi: 10.1371/journal.pntd.0010855.
- [7] P. Parola, C. D. Paddock, et D. Raoult, « Tick-borne rickettsioses around the world: emerging diseases challenging old concepts », *Clin Microbiol Rev*, vol. 18, no 4, p. 719-756, oct. 2005, doi: 10.1128/CMR.18.4.719-756.2005.
- [8] M. Sarih, C. Socolovschi, N. Boudebouch, M. Hassar, D. Raoult, et P. Parola, « Spotted Fever Group Rickettsiae in Ticks, Morocco », *Emerg. Infect. Dis.*, vol. 14, no 7, p. 1067-1073, juill. 2008, doi: 10.3201/eid1407.070096.
- [9] G. Crispell et al., « Discovery of Alpha-Gal-Containing Antigens in North American Tick Species Believed to Induce Red Meat Allergy », *Front. Immunol.*, vol. 10, mai 2019, doi: 10.3389/fimmu.2019.01056.
- [10] A. Cabezas-Cruz et al., « Environmental and Molecular Drivers of the α -Gal Syndrome », *Front. Immunol.*, vol. 10, mai 2019, doi: 10.3389/fimmu.2019.01210.
- [11] S. R. Sharma et S. Karim, « Tick Saliva and the Alpha-Gal Syndrome: Finding a Needle in a Haystack », *Front. Cell. Infect. Microbiol.*, vol. 11, juill. 2021, doi: 10.3389/fcimb.2021.680264.
- [12] A. A. Alkishe, A. T. Peterson, et A. M. Samy, « Climate change influences on the potential geographic distribution of the disease vector tick *Ixodes ricinus* », *PLOS ONE*, vol. 12, no 12, p. e0189092, déc. 2017, doi: 10.1371/journal.pone.0189092.

[13] L. M. Hernández-Triana et al., « DNA barcoding of tick species (Archnida: Ixodida) to support species identification and discovery of cryptic genetic diversity with emphasis on the British fauna », Journal of the European Mosquito Control Association, vol. 44, no 1, janv. 2026, doi: 10.52004/2054930x-20251022.



[COT3-12] First Microscopic Evidence of Avian Haemosporidian Infections in Domestic Hens (*Gallus gallus domesticus*) in Morocco: A Preliminary Survey in the Rabat-Salé-Kénitra Region

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1. Introduction

Avian haemosporidiosis are vector-borne protozoan infections caused by parasites of the order Haemosporida, infecting the erythrocytes of a wide range of avian hosts. Three genera are of veterinary importance: *Plasmodium*, *Haemoproteus*, and *Leucocytozoon*, transmitted respectively by Culicidae, Ceratopogonidae/Hippoboscidae, and Simuliidae (Valkiūnas, 2005). These parasites compromise host body condition, reproductive performance, and survival, and have been associated with mass mortality events in domestic poultry — e.g., 9% mortality in Egyptian broilers due to *Leucocytozoon caulleryi* and 16.7% in pigeons due to *Haemoproteus columbae* — as well as the extinction of endemic avifauna following vector introduction (Hawaii). Reported prevalences in African poultry range from 36.1% in Algeria to 79.2% in Kenya.

Despite this global relevance, no published data document avian haemosporidian infections in Morocco, although the country presents favorable climatic conditions, intense migratory bird traffic, and confirmed presence of competent dipteran vectors (*Culex pipiens*, *Aedes* spp., *Culicoides* spp.). Moroccan passerines have been reported as *Plasmodium* carriers (Hellgren et al., 2021), suggesting active circulation with potential spillover to poultry — particularly within the rapidly expanding free-range (beldi) sector supported by the National Initiative for Human Development (INDH).

2. Objectives

This study aimed to (i) detect and morphologically characterize avian haemosporidian parasites in domestic hens (*Gallus gallus domesticus*) in the Rabat-Salé-Kénitra region; (ii) estimate prevalence in two contrasting production systems; and (iii) generate baseline data for nationwide surveillance.

3. Materials and Methods

A cross-sectional survey was conducted between 19 March and 4 July 2022 in the Rabat-Salé-Kénitra region. A total of 208 hens aged 80–90 weeks were sampled: 97 free-range (beldi) chickens from Ait Ichou (Khémisset province) raised in traditional outdoor shelters, and 111 spent commercial laying hens from the IAV Hassan II Avian Pathology clinic (n = 44) and the Akkari wholesale market in Rabat (n = 67). Older birds were deliberately selected to maximize cumulative vector exposure.

Approximately 0.5–1 mL of blood was drawn from the brachial vein into EDTA tubes. Thin blood smears were stained with the RAL 555 rapid May-Grünwald-Giemsa kit and examined under a Leica light microscope at ×1000 (oil immersion). Intraerythrocytic stages were identified following Valkiūnas (2005) and Samour (2008), based on parasite morphology, nuclear position, pigment distribution, and host cell deformation.

Suspect samples were stored at –20 °C for DNA extraction (Qiagen DNeasy Blood & Tissue Kit) and quantified with a Qubit® 3.0 fluorometer. Conventional PCR targeted the mitochondrial cytochrome b gene using genus-specific primer pairs: AE980/AE982 for *Haemoproteus* (346 bp) and AE983/AE985 for *Plasmodium* (580 bp) (Pacheco et al., 2018).

Reactions (25 μ L) were run for 36 cycles (95 °C / 30 s; 42 °C / 30 s; 72 °C / 1 min). Leucocytozoon primers were excluded based on negative microscopy. Amplicons were visualized on 1% agarose gels under UV.

4. Results

Of the 208 hens examined, 93 (44.71%) were positive by microscopy. Intraerythrocytic gametocytes morphologically compatible with Plasmodium spp. and/or Haemoproteus spp. were observed, while no Leucocytozoon stages were detected.

Production system	Negative	Positive	Prevalence (95% CI)
Spent laying hens	141	66	46.80% (38.3–55.4%)
Free-range chickens	67	27	40.29% (28.5–53.0%)
Total	208	93	44.71% (37.9–51.7%)

PCR amplification yielded inconclusive results: no clear bands at the expected sizes (346 bp / 580 bp) were obtained, likely due to low parasitaemia in chronic infections or sensitivity limitations of single-round PCR. A predictive risk map based on temperature, precipitation, and altitude (< 1700 m) identified additional Moroccan regions — including the Gharb plain, the Saïss basin, and the Middle Atlas foothills — as climatically suitable for haemosporidian transmission.

5. Discussion

This study constitutes, to our knowledge, the first documented microscopic detection of avian haemosporidian parasites in domestic poultry in Morocco. The 44.71% prevalence places Morocco within the mid-range of African reports and confirms that haemosporidiosis are not absent from North African poultry — they have been overlooked.

The complete absence of Leucocytozoon is biologically consistent with the habitat requirements of its Simuliidae vectors (fast-flowing freshwater), geographically restricted in the sampling area. Conversely, the suspected presence of Plasmodium and/or Haemoproteus aligns with the documented Moroccan distribution of Culex pipiens and Culicoides spp.

The slightly higher prevalence in spent laying hens (46.80% vs 40.29%) is compatible with the higher vector pressure expected under intensive housing (warmth, humidity, accumulated droppings). However, overlapping confidence intervals and the convenience-sampling design preclude causal inference. The failure of PCR confirmation reflects a known limitation of single-round protocols in low-parasitaemia chronic infections; nested PCR (Hellgren et al., 2004) followed by Sanger sequencing and MalAvi database comparison are the logical next steps for genus and lineage assignment.

6. Conclusion

This preliminary survey provides the first microscopic evidence of avian haemosporidian infections in Moroccan poultry, with nearly half of the sampled hens showing intraerythrocytic parasites compatible with Plasmodium and/or Haemoproteus. The findings reveal a previously neglected parasitic burden of potential economic and One Health relevance, particularly for the expanding beldi sector. Future work should prioritize molecular confirmation through nested PCR and sequencing, entomological vector incrimination, geographic expansion of sampling, and integration of avian haemosporidiosis into national veterinary surveillance.



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THE PROCEEDINGS BOOK



[COT3-13] Epidemiological Study of Filarial Infections in Dogs from Marrakech Province, Morocco

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1. Introduction

Filarial nematodes are vector-borne parasites that infect a wide range of domestic and wild animals worldwide. In dogs, filarial infections are particularly prevalent in warm and subtropical regions where environmental conditions favor the development and proliferation of hematophagous arthropod vectors, especially mosquitoes. These parasites are of considerable veterinary and public health importance due to their pathogenic effects on animal health and their zoonotic potential. Among canine filarial species, *Dirofilaria immitis*, the causative agent of canine heartworm disease, and *Dirofilaria repens*, responsible for subcutaneous dirofilariosis, are the most extensively studied. Both species may occasionally infect humans, causing pulmonary, ocular, or subcutaneous lesions. Other filarial nematodes, including species belonging to the genus *Acanthocheilonema*, are less frequently investigated despite their widespread occurrence in canine populations. Their epidemiological significance is often underestimated because infections are frequently asymptomatic or associated with non-specific clinical signs. In addition, diagnostic limitations may hinder accurate species identification and surveillance. In Morocco, information regarding the epidemiology of canine filarial infections remains scarce, particularly in free-roaming dog populations that may act as reservoirs for parasite maintenance and transmission. Stray dogs are often exposed to high vector densities and generally do not benefit from preventive veterinary care, making them particularly vulnerable to infection. Understanding the prevalence and distribution of filarial parasites in these populations is essential for evaluating animal health risks and potential zoonotic threats. The present study aimed to determine the prevalence of filarial infections among stray dogs in Marrakech Province, Morocco, using a combination of parasitological, antigenic, and post-mortem diagnostic approaches. The findings contribute to a better understanding of the epidemiological situation of canine filarioses in the region and provide evidence to support surveillance and control strategies.

2. Materials and Methods

A cross-sectional epidemiological survey was conducted between March and May 2026 in several municipalities of Marrakech Province, including Marrakech, Méchouar-Kasbah, Al Ouidane, Saâda, Tassoultante, Tamansourt, and Ouled Hassoune. A total of 411 stray dogs were included in the study. Animals were sampled as part of municipal dog management and veterinary health monitoring activities. Blood samples were collected and examined for the detection of circulating microfilariae using a combination of parasitological and antigenic diagnostic methods. The diagnosis of filarial infections was based on microscopic examination of blood samples using both thick blood smear and fresh blood examination between slide and coverslip for the detection of circulating microfilariae. In addition, antigenic tests specific for *D. immitis* were performed to identify occult infections and improve diagnostic sensitivity. Furthermore, post-mortem examinations were conducted on dogs that had died as a result of road traffic accidents. Necropsy investigations focused on the cardiovascular system, particularly the heart and pulmonary arteries, to detect the presence of adult filarial worms. The identification of adult worms recovered during necropsy provided additional confirmation of *D. immitis* infections and contributed to a more accurate assessment of parasite circulation in the study area. Positive cases were classified according to the diagnostic findings. The prevalence of infection was calculated by dividing the number of positive animals by the total number of examined dogs and expressed as a percentage. Descriptive epidemiological analyses were performed to assess the distribution of filarial infections within the surveyed stray dog population.

3. Results

Among the 411 stray dogs examined, 54 animals tested positive for circulating microfilariae, corresponding to an overall prevalence of 13.1%. The detection of *D. immitis* was confirmed in 5 dogs, representing a prevalence of 1.2% (5/411). Infections compatible with *D. repens* or *Acanthocheilonema* spp. were identified in 49 dogs, corresponding to a prevalence of 11.9% (49/411). These findings indicate that filarial infections are present in the stray dog population throughout the surveyed area. The majority of positive cases were associated with filarial species other than *D. immitis*, suggesting a broader diversity of circulating filarial parasites in the region than previously documented. The relatively high proportion of dogs harboring microfilariae demonstrates active transmission cycles involving competent arthropod vectors. The detection of both zoonotic and non-zoonotic filarial species highlights the epidemiological complexity of canine filarioses in Marrakech Province.

4. Discussion

The overall prevalence of 13.1% observed in this study indicates substantial exposure of stray dogs to filarial parasites in the Marrakech region. Climatic conditions characterized by relatively high temperatures and the presence of suitable mosquito, Tick and fly populations may facilitate parasite transmission and support the persistence of infection cycles. The low prevalence of *D. immitis* compared with the higher prevalence of infections compatible with *D. repens* or *Acanthocheilonema* spp. may reflect ecological, biological, or vector-related differences influencing parasite distribution. Similar patterns have been reported in several Mediterranean and North African regions, where subcutaneous filarial infections are often more common than canine heartworm disease. Stray dogs represent a particularly important epidemiological reservoir because they are continuously exposed to vectors and generally remain untreated throughout their lives. Consequently, infected animals may contribute significantly to the maintenance of microfilaremia within the canine population and facilitate parasite transmission to susceptible hosts. From a public health perspective, the detection of zoonotic filarial species is of particular concern. Human infections caused by *Dirofilaria* spp. have been increasingly reported worldwide, including in Mediterranean countries. Although human infections are accidental, the presence of infected canine reservoirs and competent vectors increases the likelihood of transmission events.

5. Conclusion

The findings confirm that stray dogs constitute an important reservoir for canine filarial infections and may contribute to the maintenance and spread of these parasites in the environment. Given the zoonotic potential of some filarial species, the presence of infected animals represents a relevant public health concern. Strengthening epidemiological surveillance, improving diagnostic capabilities, implementing vector control programs, and promoting preventive veterinary measures are essential steps to reduce the burden of canine filarioses and limit their transmission in Marrakech Province and other regions of Morocco.