SUPERFICIAL FUNGAL INFECTIONS
Training for national and district-level health workers
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LEARNING OBJECTIVES – SUPERFICIAL FUNGAL INFECTIONS

NAME
The most common pathogens responsible for superficial fungal infections

DESCRIBE
The epidemiology and pathology of superficial fungal infections

DESCRIBE
The clinical presentation and diagnosis of superficial fungal infections

EXPLAIN
The therapeutic management plan for superficial fungal infections

UNDERSTAND
The importance of drug-resistant dermatophytes and how to mitigate its effects
MODULE 1

MODULE OVERVIEW

Part 1: Introduction to Neglected Tropical Diseases
Part 2: General Overview and Classifications of Superficial Fungal Infections
Part 3: Epidemiology of Superficial Fungal Infections
Superficial fungal infections are a group of highly common skin diseases across the globe that are not classified as neglected tropical diseases. However, the WHO skin-related NTD strategic framework promotes the identification of multiple skin conditions in a single intervention. Since superficial fungal infections are often co-endemic with many cutaneous NTDs, those dealing with NTDs should also be familiar with diagnosing and treating superficial fungal infections.

**Part 1** will give a brief overview of neglected tropical diseases and their impact. The remaining parts of this module will focus specifically on superficial fungal infections.
PART 1

Introduction To NTDs
Neglected Tropical Diseases (NTDs):

- Comprise 20 diseases or disease groups that affect more than 1 billion mostly poor people, mainly in the world’s tropical and sub-tropical areas.

- They are caused by bacteria, viruses, helminths, ectoparasites, fungi, protozoa, or without infectious causes.

- Superficial fungal infections are not classified as NTDs but still affect many people globally, especially in the tropics and subtropics.
A very diverse group of diseases:

- Bacterial, viral, parasitic, fungal, noncommunicable
- Mainly prevalent in tropical areas
- Mainly affecting the poorest sectors of the populations
- Complex epidemiology, often related to environmental conditions
- Many are vector-borne and/or have animal reservoir
- Some are associated with disabilities, deformities and social exclusion

Geographical and social environment
Often **overlooked** although associated with a significant burden of disease:

- Approximately 19 million disability-adjusted life years (DALYs)
- 1% of the global burden of disease (GBD), with large variability between countries
- 1.7 billion people requiring treatment/year (as of 2020)
THE NEGLECTED TROPICAL DISEASES

Helminths
- Taeniasis / Cysticercosis
- Echinococcosis
- Dracunculiasis
- Foodborne trematodiases
- Lymphatic filariasis
- Soil-transmitted helminthiases
- Schistosomiasis
- Onchocerciasis

Protozoa
- Chagas disease
- Leishmaniasis
- Human African trypanosomiasis

Viruses
- Rabies
- Dengue and Chikungunya

Ectoparasites
- Scabies
- Tungiasis
- Cutaneous larva migrans

Bacteria
- Buruli ulcer
- Leprosy
- Trachoma
- Yaws

Fungi
- Mycetoma
- Chromoblastomycosis and other deep mycoses

Non-communicable Diseases
- Snake bite envenoming

Protozoa
- Trypanosomiasis

Helminths
- Taenia saginada
- Taenia solium
- Ascaris lumbricoides
- Strongyloides stercoralis
- Necator americanus

Viruses
- Rabies
- Dengue and Chikungunya

Protozoa
- Plasmodium falciparum
- Trypanosoma brucei

Fungi
- Blastomyces dermatitidis
- Coccidioides immitis

Helminths
- Schistosoma mansoni
- Schistosoma japonicum

Viruses
- Yellow fever
- Zika

Protozoa
- Leishmania donovani

Fungi
- Cryptococcus neoformans

Helminths
- Necator americanus

Viruses
- Hanta virus

Protozoa
- Toxoplasma gondii

Fungi
- C. neoformans

Helminths
- Schistosoma mansoni

Viruses
- Yellow fever

Protozoa
- Trypanosoma brucei

Fungi
- C. neoformans

Helminths
- Necator americanus

Viruses
- Hanta virus

Protozoa
- Toxoplasma gondii

Fungi
- C. neoformans

Helminths
- Necator americanus

Viruses
- Yellow fever

Protozoa
- Trypanosoma brucei

Fungi
- C. neoformans

Helminths
- Necator americanus

Viruses
- Hanta virus

Protozoa
- Toxoplasma gondii

Fungi
- C. neoformans
Neglected Tropical Diseases

5 Core Strategic Interventions

- Preventive chemotherapy (PC)
- Individual case management
- Vector control
- Water, sanitation and hygiene (WASH)
- Veterinary public health
• Have skin manifestations, including ulcers, patches, nodules, wounds and swelling.
• Include – Buruli ulcer, deep fungal infections, dracunculiasis*, leishmaniasis, leprosy, lymphatic filariasis, mycetoma, onchocerciasis, scabies and other ectoparasitoses and yaws*.

* Targeted for eradication

Credit photo: WHO
PART 2
General Overview and Classifications of Superficial Fungal Infections
Superficial fungal infections, also known as dermatomycoses, are common infections estimated to affect around **1 billion people** worldwide (Hay et al, 2014; Bongomin et al, 2017). These infections most frequently affect the skin, hair, and nails of humans.

There are **over 100 000 species** of fungi across the world. The superficial infections affecting humans are non-life threatening.

Fungi that cause skin infections thrive in warm and humid areas with temperatures between 25 -28°C. These pathogens are particularly **prevalent in temperate and tropical countries**.

People with low socio-economic status, crowded living conditions, close animal contact, and sub-optimal hygiene are at greater risk of contracting these diseases.
There are 3 main types of superficial fungi:

- **dermatophytes,**
- **non-dermatophyte molds,** and
- **yeasts.**

**DERMATOPHYTES**
- Mold fungi that grow in chains of cells and live in the outer layer of the skin
- Cause dermatophytosis, commonly known as tinea or ringworm
- Most common fungal genera: *Trichophyton, Microsporum, Epidermophyton*
  - *Trichophyton rubrum* is the most common cause of dermatophyte infection in the world.
- Do not cause systemic infection

**Non-dermatophyte MOLDS**
- Multicellular, filamentous fungi
- Non-dermatophyte molds only rarely cause skin infections eg nail infections.
- But can cause severe systemic infections in immunocompromised individuals

**YEASTS**
- Unicellular, rounded fungi that reproduce via budding
- Can live on skin, mucous membranes, or inside the human body
- Cause candidiasis and pityriasis versicolor
- Most common genera: *Candida, Malassezia*
- Can cause severe systemic infections, especially in elderly and immunocompromised individuals
Superficial Fungal Infections
Classification

Mycelial filaments of a mold
Courtesy of Dr. Lamia Bouraoui, Algiers, Algeria

Candida albicans yeasts
Courtesy of Professor S. Zobiri, Mustapha Pacha University Hospital, Algiers, Algeria

Mastering the Terminology
Dermatomycosis: skin infection due to any fungal pathogen
Dermatophytosis: skin infection due to dermatophytes

Key Point
Dermatophytes are molds that specifically live on the skin
Dermatophytes can further be classified into 3 groups based on reservoir preference: anthropophilic (humans), zoophilic (animals), and geophilic (soil).

**Anthropophilic**
Spread via human-to-human contact; household dust can act as a reservoir for spores

- *e.g.* Trichophyton rubrum
- Epidermophyton floccosum
- Trichophyton tonsurans
- Trichophyton soudanense
- Trichophyton violaceum
- Microsporum audouinii

**Zoophilic**
Animal reservoir such as cats, dogs, and rabbits; Spread via animal-to-human contact

- *e.g.* Trichophyton mentagrophytes
- Trichophyton erinacei
- Trichophyton verrucosum
- Microsporum canis

**Geophilic**
Fungi found in soil; sporadically infect humans but highly virulent

- *e.g.* Nannizzia gypsea (formerly Microsporum gypseum)

These lists are not exhaustive.
PART 3
Epidemiology
Recent estimates show that at least 1 billion people and potentially up to 20-25% of the global population have superficial fungal infections (Hay et al, 2014; Bongomin et al. 2017). Increased mass tourism, migration, and travel have contributed to the increased global spread of several fungi species.

The greatest burden of skin fungal diseases (Urban et al, 2017):
- By age: children ages 1-5 and elderly
- By location: sub-Saharan Africa
- By gender: males

*Fig 2. Age-standardized DALY rate of fungal skin diseases based on sex and geographic GBD super regions in 2017. DALY, Disability-adjusted life year; GBD, global burden of disease.*

Urban et al. 2021
TRANSMISSION

Superficial fungal infections can be transmitted via human-to-human contact, via human-to-animal contact, or through the soil.

People who live or work in crowded environments, especially in warm and humid climates, are at significantly increased risk of contracting these infections.

People who live or work with domestic or stray animals are at increased risk of contracting zoophilic dermatophytes.

Furthermore, poor hygiene habits such as infrequent changes of clothing are associated with infection.
Superficial fungal infections affect all types of people on all the habitable continents of the world.

The majority of these infections are caused by one of two dermatophyte genera - *Trichophyton* spp. and *Microsporum* spp.

Furthermore, rising temperatures due to climate change have cause increased geographical expansion of many fungal pathogens. This means that superficial fungal infections will continue to increase in prevalence in the coming years (Gadre et al, 2022).
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THANK YOU