

## **Practical Checklist for implementation of Antifungal Stewardship Programs**

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Antifungal stewardship programs (SPs) are needed to be implemented in health care facilities to limit overuse or misuse of antifungals [1,2] that was proven to be responsible for an increase in antifungal resistance [3]. Antifungal SPs were indeed demonstrated to have an impact, in particular on antifungal consumption and antifungal expenditure, according to a systematic review [4]. Moreover, this review demonstrated that active interventions including a review of prescriptions had more impact than implementation of treatment guidelines only. Thus, in line with the core elements edited by the Mycoses Study Group Education and Research Consortium [5] and the Centers for Disease Control and Prevention [6], it is of utmost importance to establish a practical checklist that may be used at each health care facility level to implement antifungal SPs.

This checklist includes the following items:

- Leadership support
- Actions to support optimal antifungal use
- Actions to monitor antifungal prescribing, use, and resistance
- Education program

**Table 1.** Check-list for leadership support including essential items.

<b>LEADERSHIP SUPPORT</b>	<b>NEEDED TO BE ESTABLISHED AT FACILITY</b>	
<b>*Essential</b>		
A*. Does your facility leadership provide a formal statement that supports efforts to improve antifungal use (antifungal stewardship)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
B*. Does your facility leadership ensure that antifungal stewardship activities are integrated in other boards (e.g. Drug and Sterile Medical Devices Committee, anti-infective drugs committee)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Does your hospital have a stand-alone Antifungal SP or is this a component of the hospital Antimicrobial SP?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
D. Does your facility leadership promote interaction with regional or national health authorities?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
E. Does your facility receive any financial support for antifungal stewardship activities (e.g., support for salary, training)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
F. Does your facility leadership provide SP leader(s) dedicated time to manage antifungal SP?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>ACCOUNTABILITY</b>		
<b>*Essential</b>		
A*. Does your facility have leader or co-leaders to manage antifungal SP activities?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
a. Is there an infectious disease physician leader responsible for stewardship activities at your facility?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
b. Is there a pharmacist leader responsible for stewardship activities at your facility?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
c. Is there a leader responsible for program outcome?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
B*. Does antifungal SP leaders have regularly scheduled meetings? If yes, at what frequency:	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Does your facility have a formal multidisciplinary group that manage antifungal SP (e.g. antifungal group)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
D. Does staff from key support departments have sufficient time to contribute to stewardship activities? If yes, provide the dedicated time:	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>KEY SUPPORT FOR THE ANTIFUNGAL STEWARDSHIP PROGRAM</b>		
<b><i>Does any of the staff below work with the stewardship leaders to improve antifungal use?</i></b>		
A. Pharmacists	<input type="checkbox"/> Yes	<input type="checkbox"/> No
B. Clinicians - Which specialities ?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Infectious disease specialists	<input type="checkbox"/> Yes	<input type="checkbox"/> No
D. Mycology (Laboratory)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
E. Pharmacology	<input type="checkbox"/> Yes	<input type="checkbox"/> No
F. Infection Prevention and Control	<input type="checkbox"/> Yes	<input type="checkbox"/> No
G. Information Technology (IT)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
H. Nursing staff	<input type="checkbox"/> Yes	<input type="checkbox"/> No
I. Quality improvement	<input type="checkbox"/> Yes	<input type="checkbox"/> No
J. Education department	<input type="checkbox"/> Yes	<input type="checkbox"/> No

**Table 2.** Check-list for actions to support optimal antifungal use including essential items.

<b>ACTIONS TO SUPPORT OPTIMAL ANTIFUNGAL USE</b>		
<b>POLICIES</b> <i>*Essential</i>	<b>POLICY ESTABLISHED</b>	
<b>A*.</b> Does your facility have facility-specific treatment recommendations, based on national guidelines and local susceptibilities, to assist with antifungal selection for common clinical conditions?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
B. Does your facility have implemented tools to help clinicians with the off-labelled use of antifungals?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Does your facility have implemented tools that help prescribers to document in the medical record or during order entry a dose, duration, and indication for all antifungal prescriptions?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>SPECIFIC INTERVENTIONS TO IMPROVE ANTIFUNGAL USE</b>		
<i>Are the following actions to improve antifungal prescribing conducted in your facility?</i>		
<b>BROAD INTERVENTIONS</b> <i>*Essential</i>	<b>ACTION PERFORMED</b>	
<b>A*.</b> Does your facility have an infectious disease telephone counselling, a bedside case management or a mobile team for antifungals?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>B*.</b> Does your facility have access to the results of both fungal culture and non-culture-based tests (e.g. biomarkers, PCR)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Does your facility have access to rapid yeast and mould identification (<24h)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
D. Does a physician or pharmacist review courses of therapy for specified antifungal agents (i.e. prospective audit with feedback) at your facility? If yes, for which antifungals:	<input type="checkbox"/> Yes	<input type="checkbox"/> No
E. Is there a formal procedure for all clinicians to review the appropriateness of all antifungals after the initial orders?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
F. Do specified antifungal agents need to be approved by a physician or pharmacist prior to dispensing (i.e., pre-authorization) at your facility? If yes, for which antifungals:	<input type="checkbox"/> Yes	<input type="checkbox"/> No
G. Does your facility perform antifungal use evaluation (postprescription review) for specific antifungal agents to identify opportunities to improve use? If yes, for which antifungals and at what frequency:	<input type="checkbox"/> Yes	<input type="checkbox"/> No
H. Does your facility have access to rapid diagnostic test for any fungal agent, including point of care?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
I. Does your facility have access to antifungal therapeutic drug monitoring? If yes, provide the time delay before results are available:	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>PHARMACY-DRIVEN INTERVENTIONS</b>		
<i>Are the following actions implemented in your facility? *Essential</i>		
<b>A*.</b> Alerts in situations where therapy might be reevaluated or discontinued?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
B. Changes from intravenous to oral antifungal therapy in appropriate situations?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Dose optimization (pharmacokinetics/pharmacodynamics) in cases of organ dysfunction or drug interactions, particularly for azoles?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
D. A computer-assisted real-time request of all antifungal prescriptions?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>DIAGNOSIS AND INFECTIONS SPECIFIC INTERVENTIONS</b>		
<i>Does your facility have treatment recommendations based on international (e.g. guidelines of the European Society of Clinical Microbiology, the European Confederation of Medical Mycology, or the Infectious Diseases Society of America) or national consensus guidelines, to ensure optimal use of antifungals to treat the following common infections? *Essential</i>		
<b>A*.</b> Invasive candidiasis	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>B*.</b> Invasive aspergillosis	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Mucormycosis	<input type="checkbox"/> Yes	<input type="checkbox"/> No
D. Cryptococcosis	<input type="checkbox"/> Yes	<input type="checkbox"/> No
E. Candiduria	<input type="checkbox"/> Yes	<input type="checkbox"/> No
F. Empirical invasive candidiasis	<input type="checkbox"/> Yes	<input type="checkbox"/> No
G. Diagnostic-driven approach for empiric/pre-emptive treatment of invasive fungal infections?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
H. Antifungal prophylaxis (primary and/or secondary)	<input type="checkbox"/> Yes	<input type="checkbox"/> No

**Table 3.** Check-list for actions to monitor antifungal prescribing, use, and resistance, including essential items.

<b>ACTIONS TO MONITOR ANTIFUNGAL PRESCRIBING, USE, AND RESISTANCE</b>		
<b>PROCESS MEASURES</b> <i>*Essential</i>	<b>MEASURE PERFORMED</b>	
<b>A*. Does your SP monitor the issue of traceability?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
B. Does your SP monitor adherence to facility-specific treatment recommendations?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Does your antifungal SP monitor preauthorization interventions?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
D. Does your antifungal SP monitor antifungal use including implementing SPI (Suivi Prospectif des Indications)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
E. Does your facility have a local surveillance system for major invasive fungal diseases?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>ANTIFUNGAL USE AND OUTCOME MEASURES</b> <i>*Essential</i>	<b>MEASURE PERFORMED</b>	
<b>A*. Does your facility have access to an antifungal susceptibility report?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>B*. Does your facility define outcome measures (i.e. antifungal consumption, antifungal resistance, or patient-level outcomes such as treatment efficacy, adverse effects occurrence, or hospital length of stay) to follow antifungal use from year to year?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Does your facility produce a report on the incidence of major invasive fungal diseases?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<i>Does your facility monitor antifungal use (consumption) at the unit and/or facility wide level by one of the following metrics:</i>	<b>MEASURE PERFORMED</b>	
<b>D*. At the facility level?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>E*. At the unit level including intensive care unit, haematology, and pneumology?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>F*. By number of grams of antifungals used per 1000 hospitalization days (Defined Daily Dose, DDD)?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
G. By counts of antifungal(s) administered to patients per day (Days of Therapy, DOT)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
H. By direct expenditure for antifungals (purchasing costs)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>REPORTING INFORMATION TO STAFF ON IMPROVING ANTIFUNGAL USE AND RESISTANCE</b> <i>*Essential</i>	<b>MEASURE PERFORMED</b>	
<b>A*. Does you SP share facility and/or prescriber-specific reports on antifungal use?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<b>B*. Has a current antifungal susceptibility profile been distributed to prescribers at your facility?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Do prescribers ever receive direct, personalized communication about how they can improve their antifungal prescribing?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
D. Does antifungal SP leaders share priorities with prescribers and/or facility leadership to improve antifungal use?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

**Table 4.** Check-list for education program including essential items.

<b>EDUCATION PROGRAM</b> <i>*Essential</i>		
<b>A*. Does your SP provide education to clinicians and other relevant staff including junior doctors and residents, on improving antifungal prescribing?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No
B. Is there any formalization of education provided to clinicians and other relevant staff (e.g. professional development)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
C. Does your facility support the dissemination of educative message to clinicians and other relevant staff regarding antifungal optimal use (e.g. intranet channel)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

This checklist is an adaptable framework that should be used in health care facilities on a periodic basis to assess key elements and actions to ensure optimal antifungal prescribing. This practical check-list is based on the core recommendations edited by the Mycoses Study Group Education and Research Consortium. Essential items needed to be implemented as a priority were defined in this check-list by the panel experts. To implement an antifungal stewardship program, facilities will be assisted by this checklist including essential items, whereas facilities which have already an antifungal stewardship program in place will use this check-list to develop new activities. In any case, one or more knowledgeable staff is needed to determine which action is necessary and/or feasible in their setting.

To conclude, our practical recommendation to start with antifungal stewardship activities is to:

1. Define achievable objectives according to your facility and your knowledge among the essential items of the check-list
2. Define outcome measures (e.g. antifungal consumption)
3. Share reports with prescribers and facility leadership to make them involved in antifungal stewardship program
4. Define an improvement roadmap for the next period and new objectives connected with the roadmap

## REFERENCES

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