CLINICAL AND LABORATORY STANDARDS INSTITUTE®

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M22-A3

Quality Control for Commercially Prepared Microbiological Culture Media; Approved Standard—Third Edition

This document contains quality assurance procedures for manufacturers and users of prepared, ready-to-use microbiological culture media.

A standard for US application developed through the Clinical and Laboratory Standards Institute consensus process.

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Quality Control for Commercially Prepared Microbiological Culture Media; Approved Standard—Third Edition

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Abstract

The M22 standard provides information on quality control of commercially prepared microbiological culture media to users and manufacturers. M22-A3 is a revision of the approved standard, M22-A2, published in December 1996. The standard applies to all commercial media listed in Table 2 regardless of packaging, plate, or tube design. The media included in M22-A3 are from three surveys conducted by the College of American Pathologists. The third survey, conducted in the fall of 2001, was performed in response to the many requests for further expansion of the exempt media list. M22-A3 lists an additional 27 exempt media.

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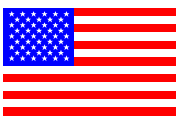

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Foreword

Quality control of commercially prepared media imposes a substantial financial burden on licensed microbiology laboratories. In response, the College of American Pathologists (CAP) conducted three laboratory surveys to determine the failure rates of commonly used media.[1,2]

The first two surveys provided data that allowed exemption of 24 of 35 assessed media from quality control. The third survey, conducted in 2001, allows the addition of 27 media to the exempt list. The data, however, cause concern. Manufacturers perform quality control on all media sold to customers. Why, then, do certain media repeatedly exhibit failure rates $\geq$0.3 or 0.5%? Less than optimum storage conditions may contribute to medium failure. Media are shipped, stored, and delivered nonrefrigerated by the manufacturer or distributor. Specialty media that require more fastidious quality control organisms also often exhibit higher failure rates. Separate, limited surveys of different U.S. and Canadian[3,4] clinical microbiology laboratories revealed a lack of standardization in the quality control of media, including processing, storage, and inoculation of quality control organisms. Until resolution of these issues, clinical laboratories must continue to verify the performance of certain medium types.

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Key Words

Commercially prepared, ready-to-use culture media; culture media; quality assurance; quality control

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1 Scope

The M22 standard provides information on quality control of commercially prepared microbiological culture media to users and manufacturers. M22-A3 is a revision of the approved standard, M22-A2, published in December 1996.

The basic premise of this standard is that the retesting of commercially prepared microbiological culture media is unnecessary for those media that are of proven reliability. The categorization of media that do not require retesting by the user is based on quality control data collected from surveys of clinical laboratories enrolled in the bacteriology proficiency-testing program conducted by the College of American Pathologists (CAP). The media types listed in the M22 standard are well established for recovery of clinically significant microorganisms. Exemption of certain media from routine quality control by the clinical laboratories assumes that media performance is monitored by an overall quality program that correlates test methods with clinical information, and monitors test procedures and specimen quality. **Media used for antimicrobial susceptibility testing have different quality control recommendations that are detailed in separate NCCLS documents.**

Changes or additions to this newest revision are the following: 1) Designation of the responsibilities of the manufacturer, distributor, and user; 2) clarification of the media included in various categories; 3) simplification of the basic protocols for the maintenance of quality control organisms; 4) incubation conditions for media quality control; 5) recommendations for the quality control of media used for certain fastidious organisms; and 6) expansion of the cutoff for acceptable failure rate from 0.3% to 0.5% and the categorization of an additional 27 media as exempt from user testing.

2 Introduction

The NCCLS Subcommittee on Media Quality Control was formed in 1984 to develop a standard that would specify the requirements for quality control of culture media. The work of this subcommittee resulted in the publication of M22 as a proposed standard in 1985 and an approved standard in 1990. A revision of M22 was published in 1996. In 2001, the document was scheduled for a second revision and the responsibility was assigned to a working group within the original subcommittee. From the inception of M22, the subcommittee has utilized the recommendations of the College of American Pathologists for the categorization of media that require quality control by the user.

CAP evaluated the failure rates of commercially prepared media in three surveys mailed to participants of the CAP Microbiology Proficiency Testing Surveys (see Table 1).[1,2] Failure rates are calculated as a raw percentage score of "total number of lots failing QC/total number of lots tested." An extrapolated failure rate is then determined by calculating what proportion of the raw rate is attributed to some type of failure detected by a QC organism. Only those media with a significant QC experience as defined by >1000 lots or >100 000 items which exhibit QC strain-related failures meet the criteria for calculation of the extrapolated failure rate.

The most recent survey (2001) evaluated 262 968 lots, among which were 32 702 833 plates, tubes, or bottles.[2] Failure rates were calculated for the 38 most commonly used media (97% of the reported lots). Reasons for media failures for all three surveys are listed in Table 1A. The extrapolated failure rate limit was raised from 0.3% to 0.5% based on analysis of the distribution of failures rates from the three surveys. Users are exempt from performing quality control of media with failure rates $\leq$0.5% (see Table 1B). Media with failure rates >0.5% continue to require user quality control.

In the United States, the Clinical Laboratory Improvement Amendments of 1988 (CLIA) issues standards for laboratory control procedures that are separate from the recommendations of NCCLS. Each laboratory must confirm the acceptance of the recommendations of NCCLS document M22 by any inspection or licensing agency used by the laboratory. See the References section for CLIA citation.[5]

3 Standard Precautions

Standard precautions should be followed when performing quality control procedures using viable microorganisms. Standard precaution guidelines are available from the U.S. Centers for Disease Control and Prevention (*Guideline for Isolation Precautions in Hospitals.* Infection Control and Hospital Epidemiology. CDC. 1996;Vol 17;1:53-80), (MMWR 1987;36[suppl 2S]2S-18S), and (MMWR 1988;37:377-382, 387-388). For specific precautions for preventing the laboratory transmission of infection from laboratory instruments and materials and for recommendations for the management of exposure, refer to the most current edition of NCCLS document M29—*Protection of Laboratory Workers from Occupationally Acquired Infections.*

4 General Responsibilities of the Manufacturer, Distributor, and User

4.1 The Manufacturer

In the United States, commercially prepared microbiological media are categorized as medical devices and are regulated by the Department of Health and Human Services (HHS), Food and Drug Administration (FDA). The Code of Federal Regulations describes Current Good Manufacturing Practice (CGMP) requirements that apply to manufacturers of commercial media.[6] This regulation includes requirements for production and process controls, establishing and maintaining activities that ensure each lot meets acceptance criteria, corrective and preventive action, labeling, device packaging, and maintaining certain records including complaint files.

Some specific elements of the Quality System Regulation (QSR) are:

- Each manufacturer shall establish and maintain procedures for finished device acceptance to ensure that each production run, lot, or batch of finished devices meets acceptance criteria (CFR Part 820, Subpart H).[6]

- Each manufacturer shall ensure that device package and shipping containers are designed and constructed to protect the device from alteration or damage during the customary conditions of processing, storage, handling, and distribution (CFR Sec. 820.130).[6]

- Each manufacturer shall establish and maintain procedures to ensure that mix-ups, damage, deterioration, contamination, or other adverse effects to product(s) do not occur during handling (CFR Sec. 820.140).[6]

- Each manufacturer shall establish and maintain procedures for the control of storage areas and stock rooms for a product to prevent damage, deterioration, contamination, or other adverse effects pending use or distribution and to ensure that no obsolete, rejected, or deteriorated product is used or distributed. When the quality of a product deteriorates over time, it shall be stored in a manner to facilitate proper stock rotation, and its condition shall be assessed as appropriate. Each manufacturer shall establish and maintain procedures that describe the methods for authorizing receipt from and dispatch to storage areas and stock rooms (CFR Sec. 820.150).[6]

- Each manufacturer shall establish and maintain procedures for control and distribution of finished devices to ensure that only those devices approved for release are distributed, and that purchase orders are reviewed to ensure that ambiguities and errors are resolved before devices are released for

The Quality System Approach

NCCLS subscribes to a quality system approach in the development of standards and guidelines, which facilitates project management; defines a document structure via a template; and provides a process to identify needed documents through a gap analysis. The approach is based on the model presented in the most current edition of NCCLS document HS1—*A Quality System Model for Health Care.* The quality system approach applies a core set of "quality system essentials" (QSEs), basic to any organization, to all operations in any healthcare service's path of workflow. The QSEs provide the framework for delivery of any type of product or service, serving as a manager's guide. The quality system essentials (QSEs) are:

Documents & Records	Equipment	Information Management	Process Improvement
Organization	Purchasing & Inventory	Occurrence Management	Service & Satisfaction
Personnel	Process Control	Assessment	Facilities & Safety

M22-A3 addresses the quality system essentials (QSEs) indicated by an "X." For a description of the other NCCLS documents listed in the grid, please refer to the Related NCCLS Publications section on the following page.

Documents & Records	Organization	Personnel	Equipment	Purchasing & Inventory	Process Control	Information Management	Occurrence Management	Assessment	Process Improvement	Service & Satisfaction	Facilities & Safety
GP2					X M2 M6 M7 M11						

Adapted from NCCLS document HS1—*A Quality System Model for Health Care*.

Path of Workflow

A path of workflow is the description of the necessary steps to deliver the particular product or service that the organization or entity provides. For example, GP26-A2 defines a clinical laboratory path of workflow which consists of three sequential processes: preanalytic, analytic, and postanalytic. All clinical laboratories follow these processes to deliver the laboratory's services, namely quality laboratory information.

M22-A3 addresses the clinical laboratory path of workflow steps indicated by an "X." For a description of the other NCCLS documents listed in the grid, please refer to the Related NCCLS Publications section on the following page.

Preanalytic					**Analytic**		**Postanalytic**	
Patient Assessment	Test Request	Specimen Collection	Specimen Transport	Specimen Receipt	Testing Review	Laboratory Interpretation	Results Report	Post-test Specimen Management
					M2 M6 M7 M11	M2 M6 M7 M11	M2 M6 M7 M11	M6

Adapted from NCCLS document HS1—*A Quality System Model for Health Care*.

Related NCCLS Publications*

GP2-A4 **Clinical Laboratory Technical Procedure Manuals; Approved Guideline—Fourth Edition (2002).** GP2-A4 contains guidelines that address the design, preparation, maintenance, and use of technical procedure manuals in the clinical laboratory.

M2-A8 **Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard—Eighth Edition (2003).** *American National Standard.* This newly revised standard contains updated recommended techniques, interpretive criteria, and quality control parameters for disk susceptibility testing. This document is complete with disk susceptibility testing tables updated for 2003 (M100-S13/M2).

M6-A **Evaluating Production Lots of Dehydrated Mueller-Hinton Agar; Approved Standard (1996).** M6-A addresses procedures for evaluating production lots of Mueller–Hinton agar and the development and application of reference media.

M7-A6 **Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard—Sixth Edition (2003).** *American National Standard.* This newly revised standard provides updated reference methods for the determination of minimal inhibitory concentrations (MICs) for aerobic bacteria by broth macrodilution, broth microdilution, and agar dilution. This document contains MIC interpretive criteria and quality control parameters tables updated for 2003 (M100-S13/M7).

M11-A6 **Methods for Antimicrobial Susceptibility Testing of Anaerobic Bacteria; Approved Standard—Sixth Edition (2004).** This standard provides reference methods for the determination of minimal inhibitory concentrations (MICs) of anaerobic bacteria by agar dilution and broth microdilution.

* Proposed- and tentative-level documents are being advanced through the NCCLS consensus process; therefore, readers should refer to the most recent editions.

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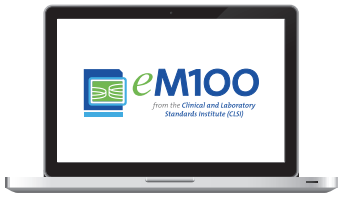

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