

## Point-of-Care Testing

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### ABSTRACT

#### Background

Point-of-care testing (POCT) is essentially any form of laboratory testing that takes place outside of the conventional or central laboratory setting and encompasses a wide variety of locations. Use of POCT has steadily increased over the 40 or so years since its introduction, principally driven by technology developments and changes in health care delivery that are aimed at delivering less costly and more effective care closer to the patient.

#### Content

This chapter describes the various POCT technologies, including those currently in use and those developed more than several decades ago such as glucose strips and lateral flow technologies. The succeeding years have seen these technologies

refined and improved to deliver easier-to-use devices with incremental improvements in analytical performance. Other major technological developments include miniaturization and co-developments in consumer electronics. The developments have enabled what are essentially laboratory instruments to be reduced in both size and complexity so that they can be used in point-of-care locations. Thus the menu of tests that can be measured with POCT devices has grown to include many of the commonly requested analytes. Developments in information technology and informatics are described that make management of POCT devices easier and allow the generation of accurate and timely results. The importance of careful implementation of POCT is also discussed with various case histories to show the clinical and cost-effectiveness of POCT compared with central laboratory testing.

### INTRODUCTION

Point-of-care testing (POCT) can be simply defined as "medical testing at the site of patient care", with the implication that appropriate and prompt decisions are made, leading to improved health outcomes. Many other terms have been used to describe POCT, including *bedside*,<sup>1</sup> *near patient*,<sup>2</sup> *physician's office*,<sup>3</sup> *centralaboratory*,<sup>4</sup> *decentralized*,<sup>5</sup> *office*, *satellite*, *kiosk*, *ancillary*, and *alternative site testing*.<sup>6</sup> In defining POCT, some may think that true POCT is testing carried out only by nonlaboratory personnel and should not include testing carried out by laboratory staff but in locations outside of the central laboratory. An example of the former is activated clotting time (ACT) measurements, which are usually performed in the operating room (OR) by nonlaboratory staff. In contrast, an example of the latter is intraoperative parathyroid hormone (PTH) measurements, which are often performed in the OR by laboratory personnel. For the purposes of this chapter, we take a broad view and define POCT as any testing done outside of the central laboratory, regardless of who performs it. POCT also includes "self-testing" in which the patient performs the tests himself or herself, and in fact, self-monitoring for blood glucose and prothrombin time (PT) or international normalized ratio (INR) together form the largest segment of the POCT market.

The first diagnostic or medical tests were performed at the bedside, then in the ward side-room, and then transferred to

dedicated laboratory areas. This reflects a similar evolution in medical care that commenced in people's homes and then to a range of different locations that can be classified as primary, secondary, and tertiary care. These developments came about through advances in science and technology being applied to the understanding and practice of medicine. Further developments in science and technology, as reflected in the advances in POCT technology, have now enabled health care providers and patients to make choices about where testing is conducted. **Box 30.1** shows the diversity of locations involved. The most prominent example of this diversity is glucose testing, which can be measured in the home by the patient, at numerous locations in the community, at the bedside by caregivers, or in the central laboratory. Currently, advances in a range of technologies and manufacturing processes, such as thin-film sensors, semiconductor engineering, plastic molding, microfluidics, nanotechnology, and consumer electronics, make it possible to adapt most of the methods used in the laboratory to the point-of-care setting.<sup>7</sup>

Several authors have suggested that we may be seeing the beginning of a movement of testing away from the central laboratory to the point of care.<sup>8-10</sup> Such a trend would clearly support the demand for improved access to health care that is closer to home and a general aim of limiting lengths of stay in hospital. There are a number of reasons for these trends, including clinical, sociologic, and economic arguments.<sup>11</sup> The need to limit the increasing cost of health care

# Pointofcare Testing

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