



PRINTING IN THE DIGITAL AGE

A WHITE PAPER TO HELP MEDICAL PROFESSIONALS
MEET TODAY'S HARD COPY NEEDS EFFICIENTLY
AND COST-EFFECTIVELY

Today's printing needs are more diverse than ever before, with an expanded range of diagnostic imaging modalities, cameras in the OR and the digitalization of information in departments from pathology laboratories to ophthalmology.

EXECUTIVE SUMMARY

Even in today's digital age, hardcopy image output remains significant throughout the medical environment. With diminished printing volume, however, assessing specific printing needs and purchasing appropriate technology is key to efficient and cost-effective print planning.

This white paper examines the requirements of various healthcare printing applications, as well as printer technologies, quality measures, special features and more to help medical professionals plan appropriate purchases.

I. THE ONGOING NEED FOR HARD COPY IMAGES

The file rooms are shrinking, and darkrooms have gone dim. But, hardcopy is still very evident in healthcare. What is driving the ongoing demand for printed images?

Communication with other medical specialists is one answer. Clinicians viewing diagnostic images—from general practitioners and surgeons to specialists such as neurologists and orthopedists—often prefer hard copy. These doctors, who look at images only occasionally and have no training in digital reading, often find working with electronic data unnecessarily complex and time-consuming. Moreover, hardcopy output helps avoid the all-too-common incompatibilities among PACS (picture archiving and communications systems) solutions.

When it comes to radiologists, some also prefer film after years of hard copy reading. And, of course, printed diagnostic images often are the easiest to provide to patients.

Additionally, in a range of medical specialties, particularly surgery, images are used in applications beyond patient diagnosis. Hardcopy also is often the simplest and most reliable means of sharing these.

No one would argue that as digital imaging expands, print volume is shrinking. The challenge today is finding medical printing solutions that meet a facility's comprehensive needs efficiently and cost-effectively.

II. IDENTIFYING YOUR SPECIFIC PRINTING NEEDS

While lower in volume, today printing needs are more diverse than ever before with an expanded range of diagnostic imaging modalities, cameras in the operating room and the digitalization of information in departments from pathology laboratories to ophthalmology. Combined with this is an ongoing volume of patient and administrative reports also often created in hard copy.

Most medical facilities will realize greater efficiencies and cost-savings by purchasing various printers fine-tuned to their specific needs than by opting for one of today's all-purpose printers that typically provides many options a site will never need. A custom-crafted multi-printer solution will also offer built-in redundancy and the ability to site units nearby users as well as to select specialized workflow-enhancing features not offered on larger, multi-purpose devices. As medical facilities seek to update or enhance their printing, the first step is to identify their full range of printing needs and review today's printing options.

A. RADIOLOGY AND RELATED DIAGNOSTIC IMAGES

For patient diagnosis

In radiology, accurate diagnosis is critical. The most important consideration in selecting any radiology printer—and printers for any anatomical images used for patient diagnosis—is whether

DICOM

DICOM stands for digital information communications in medicine, which has become the standard format for managing, storing, printing and communicating images and information for most diagnostic imaging modalities. A DICOM file or object is a data set that contains not only a medical image, but information about the patient. DICOM files can be exchanged among DICOM-compliant IT solutions, and are typically managed by PACS (picture archiving and communications systems). DICOM-compliant hardware, such as a printer, may be attached to a DICOM PACS network or directly to a modality.

DICOM files also support related services, including printing. All DICOM files include a standard calibration that ensures consistent appearance on different printers' hard copy printouts and displays.

diagnostic quality output is needed for primary reading by a radiologist or other medical specialist. For most imaging modalities, resolution is the key factor determining diagnostic quality, with a 300 to 400 dpi as a rule of thumb. Multiple factors, however, affect the quality of image output. (See IV. Judging Print Quality, below.)

Support for the DICOM (digital image and communications in medicine) (See Sidebar) format, the standard for digital diagnostic medical image storage and communication, may be required for some applications. A wide variety of affordable, versatile DICOM printers is available. These are the best choice for many types of radiology printing. However, non-DICOM devices can accept DICOM files when equipped with converter boxes. Whether a modality requires monochrome or color output also must be considered.

Additionally, most medical printing applications call for a medical grade device, which meets certain criteria that guarantee safety and performance in the challenging healthcare environment. Most diagnostic medical imaging printers also will require some type of FDA 510k pre-market clearance. (See Sidebar)

- **CR/ DR, CT and MRI**

CR/ DR, CT and MRI images are generally output on monochrome film in 300 dpi resolution. As inherently DICOM data, they usually are routed through a PACS for management and require a DICOM printer, such as the Sony FilmStation UP-DF500, UPDF550. Because film format varies with the anatomy involved, a DICOM printer should accommodate a variety of film sizes-from 11x14-inch to 14x17-inch for CR and DR to 10x12-inch for MRI reconstructions to 14x17-inch for multiple slices of MRI and CT. Because these multi-slice images are typically printed several on a page, image layout and therefore film size also involve physician preference.

- **Full-Field Digital Mammography**

According to MQSA (Mammography Quality Standards Act) regulations, all imaging sites must own or have access to a printing device to produce mammograms in hard copy at the patient's request.

Detailed DICOM, full-field digital mammography (FFDM) images call for higher resolution than most other modalities and a special FFDM high-resolution DICOM device. While specific 510k clearance for a mammography printer is not always required, many mammography printers do have clearance.

The FDA provides specific, standardized guidelines for mandatory Q/C procedures on cleared devices. Users of printers without clearance must rely on the manufacturer to ensure they are meeting FDA requirements.

Q/C procedures-from phantom image quality measurements to detector calibration-are time consuming and required weekly or even daily. Therefore, selecting a mammography printer specifically optimized for these Q/C checks also is important. Sony's Mammography FilmStation UP-DF750 is an FDA 510k cleared high-quality printer for mammography with a range of special features optimized for the modality.

- **PET/ NM (Nuclear Medicine) PET/CT**

PET, NM and PET/CT images are most often interpreted on specialized digital workstations, but may occasionally be provided on film or paper to non-radiologists following a radiologist's primary read. Because all these modalities are natively DICOM and are usually printed in color, they require a color DICOM printer. Print media size varies with anatomy as well as physician preference, typically ranging from 8x10-inches to 14x17-inches. PET and NM images are inherently lower in resolution than most radiology images because they involve the added dimension of time. But, PET/CT involves higher resolution CT images and needs an appropriate image quality.

Whatever the modality, as part of their marketing efforts, many imaging sites provide referring physicians with attractive, easy-to-read images in the referrer's preferred formats.

- **Ultrasound**

Ultrasound images also are of lower resolution than many other modalities and are generally read diagnostically in real time on digital displays. However, when not on site during the exam, radiologists, or other specialists involved are often presented with ultrasound prints for preliminary evaluation. These prints are important because they help determine the course of the exam and ultimately play a role in diagnosis.

Typically, ultrasound printers are compact, affordable thermal devices. Often, they are dedicated to a single acquisition device and are brought to the patient location on carts. Sony offers a broad selection of high-performance choices suited to most needs.

Ultrasound printers should be selected with the specific ultrasound system and exam in mind. Most video-based ultrasound systems require an analog video printer, while newer digital systems require printers with digital interface. Generally, 2D exams are output to thermal A6 paper. Today, a growing number of ultrasound devices support DICOM, particularly 3D and 4D (moving 3D images) images and therefore require a DICOM printer. If desired, these exams may be sent to a general department DICOM printer, such as the Sony FilmStation.

Color ultrasound images are used for cardiac and vascular applications, as well as 3D/4D women's imaging and usually are printed on A6 or full page paper. Sony supports these applications with its UP-D25MD and UP-D80MD printers.

With handheld ultrasound devices growing in popularity, today perhaps the largest trend affecting ultrasound printing is the increasingly compact size of acquisition devices. When paired with smaller printers, the result is easily maneuverable carts and more streamlined exams.

- **Fluoroscopy**

When used diagnostically, the moving x-ray images of fluoroscopy (C-arms) are typically interpreted in real time by a physician on a video monitor. The images are printed for medical records only (See "physician reporting education and records," below). Fluoroscopy also is frequently used to provide surgical guidance, but these images are not usually recorded or printed.

- **X-Ray Angiography/ Cardiac Catheterization**

Still cardiac and peripheral angiography x-ray images are printed on the UP-990AD/970AD, UP-D72XR and UP-D74XRD. Cardiac catheterization cine images acquired through fluoroscopy are typically read on a screen in real time. Still frames are printed for record keeping and referrer communications only (See "physician reporting education and records," below).

In addition to radiologists, other physicians may require images in full diagnostic quality for further evaluating a patient's condition and surgical planning, although radiologists are always charged with formal diagnosis. Physicians frequently requesting studies in diagnostic quality include orthopedists, neurologists and surgeons. High quality printed copies of diagnostic images also are sent to radiologists and medical specialists for consultation.

For physician reporting, education and record keeping

Hard copy reference images also are used to provide information to a variety of physicians who will treat or consult on a case but have no need for a full diagnostic quality exam. They may also be used for patient records and education.

Medical Grade

Only medical grade printers that meet certain regulated safety and performance standards may be used in a patient care environment. These standards include compliance with UL (Underwriter's Laboratory) regulations for special power supplies and groundings to protect against shock in case of contact with fluids. For medical grade designation, radiofrequency emissions generally must comply with the highest IEC (International Electro technical Commission) standards. Typically, manufacturers also will adhere to the highest ISO (International Organization for Standardization) (13485) standards for sound manufacturing and quality control practices.

Various states and cities may enforce additional criteria, and the industry itself also has voluntary standards that most manufacturers uphold.

As a result, medical grade products are more robust and reliable and are safer under extreme conditions than general consumer products.

Printers used in the OR sterile field must be medical grade and are considered medical devices regulated by the FDA. Extremely important in the OR is that all components and electronics are sealed as much as possible, to avoid exposure to OR fluids or airborne particles that may become trapped and contaminate the surgical environment.

• CT, MRI and CR/DR

For CT, MRI and CR/DR reference printing, a facility can stretch its budget with lower resolution prints produced using less costly printers and media. Media size and format is an individual preference and often determined by referring physicians, who are effectively the radiologist's "customers." Some may prefer paper prints in a convenient 8x10-inch or 5 x7-inch format for easy filing, while others want documents that combine reports and images together on a single sheet. Still others prefer the high quality of film.

DICOM reference printers, such as the Sony UP-D74XRD printer, are available to output images on economical paper media. Some diagnostic-quality DICOM printers also have lower resolution settings for referral images, but sites with large print volume may not want to tie up a workhorse diagnostic printer for referring exams.

Alternatively, sites might save DICOM reference images in JPEG or another graphic format and incorporate them into printed reports, which can be output on a variety of printers. Sony's UP-D80MD is an excellent choice for combining images and graphics on convenient letter or A-4 size paper.

• Ultrasound

Ultrasound printers used to capture images for evaluation during procedures (See II, Assessing Your Printing Needs, above) typically also are used to produce images for referral and record keeping, as a complement to video recording devices.

• Fluoroscopy

When used in diagnosis, fluoroscopy images are frequently printed for record keeping and related purposes. Because they utilize low-dose x-ray and are not DICOM format, these images may be printed on a variety of monochrome medical printers, such as Sony's UPD897/990AD/970AD.

• X-Ray Angiography/ Cardiac Catheterization

Cardiac catheterization cine and angiography images also are printed for referral purposes on such printers as Sony's UP-970AD/UP-990AD.

Whatever the modality, as part of their marketing efforts, many imaging sites provide referring physicians with attractive, easy-to-read images in the referrer's preferred formats. This is a sound marketing practice in today's competitive healthcare environment, and printer choice plays a key role.

B. SURGERY

Surgeons in many specialties acquire video or still pictures in the OR and output select images to hard copy—typically for use in patient records, physician training, and patient education.

Minimally invasive surgeons work with endoscopic or laparoscopic camera systems to visualize the patient's internal anatomy. These procedures are often recorded using digital video recorders or digital capture systems. Ophthalmologists and neurosurgeons attach cameras to surgical microscopes to capture still and video images. General surgeons may also record and print images of the open body cavity during procedures. Finally, images of the OR environment itself may be recorded to help educate the surgical team and to enhance team performance.

Surgical images are typically acquired and printed in color. Since they do not involve diagnostic modalities, DICOM compatibility and film output is not relevant, and a wide range of printers are appropriate. When connected directly to the camera source, an analog video printer is required such as the Sony UP-55MD A5 model. In this configuration, surgeons often use the printer as the recording device by capturing/printing still images during the procedure. More common today,

US FDA 510k Clearance
Most printers used in a patient care environment also require some form of FDA clearance as a class 2 medical device. Printer manufacturers must declare a device's intended use, and in large part, the FDA focuses on patient safety, certifying that the device has met the UL, IEC and other organizations' standards for a particular medical application. When a device represents an upgrade or is generally similar to a previously cleared device, a letter declaring this is generally all that is required for FDA submission. The FDA classified voluntary standards under "special controls", including DICOM, JPEG and SMTP support, and are considered Class II Devices.

the printer will be connected directly to the digital video recorder or digital capture system which lies between the printer and the camera system. In this configuration, a digital interface printer is required such as the Sony UP-D55MD A5 model or UP-DR80MD A4 full page model.

Print quality is extremely important in all surgical applications because precise visualization enhances understanding of the nuances of procedures. No matter how superior the camera, what the clinician actually sees in hard copy is determined by the printer quality. Most new surgical camera systems being installed in ORs today utilize HD cameras. To take full advantage of HD acquisition, an HD printer model such as the Sony UP-55MD/HD or UP-DR80MD is required to bring the full benefits of HD to the surgical team.

Color accuracy is also important in surgical printing because color variations can provide important information about the patient's condition.

Like all printers in a patient care environment, surgical printers should be medical grade. If a printer is used in the OR within the sterile surgical field, it must meet additional patient safety and regulatory requirements. In addition to these higher safety standards, medical grade surgical printers are highly reliable since they are designed for the rigorous usage typical of the OR environment. Since high reliability is important in any medical setting, medical grade printers are even recommended for use outside of the sterile operating field such as in a lab or as a network printer at a central nurse's station.

C. PATHOLOGY

Created with cameras or specialized high-speed slide scanners, digital pathology images are also used for education and collaboration, as well as for reference databases and tumor board presentations.

Extremely data-intensive pathology images require a high quality photographic output. DICOM is not necessary. However, a medical grade device offers reliability and numerous safety features helpful in a medical lab setting. A high-quality HD dye-sublimation printer with laminated media, such as the Sony UP-D80RMD, is a good choice.

If images are created with an HD camera, the UP-DR80MD and UP-55MD/HD will provide consistent high resolution output.

D. OTHER

Medical facilities, of course, use printers for a wide range of applications in addition to the above. In cosmetic surgery, dermatology, orthopedics and other areas, often patients are photographed prior to surgery to provide surgical guidance and again afterwards to add to patient records.

A turn-key photo printing system, such as Sony's Snap Lab, can provide a fast, simple, high-quality solution for these uses. Snap Lab and similar solutions support wireless connectivity with a digital camera and instantly turn out professional prints in a variety of formats. Images also can be easily combined into before and after presentations with text and graphics for enhanced record keeping and marketing pieces.

Most medical facilities also need printers for producing text-based reports for other doctors and for internal administrative uses beyond patient care. The rigors of a medical environment, even in administrative areas, often place greater demands on printers. A printer, such as the Sony UP-DR80MD for water- and smudge-resistant prints can be a major advantage over ink jet output, which may smear in contact with fluids.

Printers utilize a variety of technologies to output hard copy suited to various medical applications. Choosing the right technology for a printing task will streamline workflow and make the most of your budget.

III. PRINTING TECHNOLOGIES

Often working in concert with specialized print media, printers utilize a variety of technologies to output hard copy suited to various medical applications. Choosing the right technology for a printing task will streamline workflow and make the most of your budget, while delivering the desired results.

- **Dye Sublimation**

These devices use heat to transfer colored dye from print ribbons onto the print media. Typically, the resulting images are high photographic quality and extremely water- and fade-resistant. Therefore, they are an excellent choice for a medical environment. The amount of heat generated by each area of the print head determines the depth of each of the colors transferred. Dye sublimation printers create crisp, clear continuous tone output frequently used for medical images, unlike the output from ink jet printers, which comprise tiny discreet drops of ink.

Dye Sub printers often work with high-quality glossy papers. Sony offers the option of special laminated media for these printers.

- **Direct Thermal**

This technology produces either color or black-and-white images by applying heat to special temperature-sensitive print media. As the paper passes over the print head, the regions exposed to varying degrees of heat become darker, creating an image. Depending on the specifics of the device and paper or film, these printers can deliver extremely high quality diagnostic output. High quality direct thermal output can be comparable to more costly laser output.

Direct thermal printers typically accommodate both a variety of papers and film.

- **Laser**

Laser devices use static electricity to create an image. The print process begins as the device shines a laser beam on the printer drum, essentially to create an electronic charge image of the desired output. As the process progresses, fine powdered printer toner adheres to the drum in varying amounts determined by the electric charge. Similarly, printing paper also is given an electric charge and the toner, and along with the image, transfers as the paper rolls through the drum. Laser printers produce an image quality that is more suited for office functions or possibly for referring physicians rather than for diagnostic printing.

Today, laser printers work with a wide variety of papers, including special coated stock.

- **Ink Jet**

Ink jet technology creates an image using a print head with small nozzles that spray extremely fine drops of ink on to the print media. The methods that print cartridges use to dispense the ink vary considerably and significantly affect print quality. The final image is made up of small discrete droplets of ink, making it less crisp and clean than continuous-tone dye sublimation printing. Consumables such as ink jet cartridges also are typically expensive, adding to the cost of ownership. Like laser devices, ink jets are generally not used to print medical images.

Ink jet printers also accommodate a large range of papers.

In addition to resolution measured in dots-per-inch, other factors count when judging print quality. Many printers offer special features that enhance image quality and workflow.

IV. JUDGING PRINT QUALITY

In addition to resolution measured in dots-per-inch, other factors count when judging print quality. Examine quality by comparing output among various printers using similar print settings. How black are the blacks? Does the background eliminate most extraneous light and enhance your ability to see the image? On monochrome imagers, look at the grayscale. Can the printer render smooth gradations of gray both horizontally and vertically? Similarly, in color printers, color gradations should be smooth, uniform and consistent with no bleeding into neighboring areas.

V. PRINTER FEATURES

Many printers, including Sony devices, offer special features that will enhance image quality, workflow and more.

- **Front loading and front bezel**

In a busy medical office, time is critical and easily accessible front controls and paper loading will enhance efficiency.

- **Automatic calibration**

Accurate color and grayscale reproduction is key in medical printing. Calibration is the process that enables matching of original images to screen and printed images. Most printer drivers provide automatic printer calibration, with varying degrees of accuracy. For medical printing, generally some manual calibration is required. Therefore, selecting a printer with easy access, precise calibration controls is important.

- **Volume/speed**

Print speed, naturally, plays an important role in workflow, but may carry a higher price tag. Sites should examine the speed for various types of output and consider their total print volume. While increased printer speed may pay for itself in enhanced productivity, some sites may find that purchasing two slower printers placed nearby users saves time in the long run. Also, if images are printed in real time-in the OR, for example-the ability to print rapidly may enable sites to capture more information than a slower printer, which has only a small cache for images waiting to be printed.

- **Network-ready**

If you plan to connect a printer to a network, a built-in network interface card is an important convenience. An external print server can be attached to a printer without network connectivity, but added time, expense and IT expertise is required.

- **Wireless connectivity**

A printer with built-in wireless LAN connectivity (WiFi) eliminates the need for network wiring. Printers also may have Bluetooth connectivity for additional flexible wireless connectivity.

- **Color management and matching**

Some color printers come with special color management systems that allow extremely precise adjustment for print and screen matching. Sony's UP-D77MD also allows these color settings to be shared across multiple printers to ensure accurate, uniform printing throughout a facility.

- **Edge-to-edge printing**

Printing without borders makes the most of your film and paper budget and produces slightly larger, more revealing images. Some printers support this.

When considering the price of a printing device, look at the total cost of ownership—including the cost of print cartridges and heads, special print media and related supplies, which can add significantly to the price.

- **Special extra-durable media**

Special laminated, water- and fingerprint-resistant media are available for some printers, such as Sony's UP-D25MD and UP-25MD, to safeguard images in a medical environment.

- **Stand-by mode**

This is a useful feature for saving on electric power consumption.

- **USB image capture**

When printing a still image from video or printing directly from a camera, the ability to save an image to a USB "thumb drive" device for future use is a significant benefit. Sony's UP-D55MD/HD offers an innovative ImagePort feature that supports this function, simplifying image transfer to a PC or directly into PowerPoint presentations.

- **Support for multiple print media**

The ability to accommodate several print media at one time with multiple trays eliminates the need to constantly swap out media. This is a particular benefit to a smaller site that does not have sufficient volume to justify the cost of separate printers dedicated to a single print format.

- **Support for multiple signal inputs**

As technology progresses, medical sites will want to take advantage of hardware they already have in place while remaining poised for the future. Therefore, a printer that accepts multiple signals, such as analog and digital or standard definition (SD) and high definition (HD), may be worth seeking out.

- **Printer size and flexible siting**

Printers come in all shapes and sizes. A compact footprint is clearly advantageous when a medical facility is short on space, particularly in the OR. A compact device also may enable more flexible siting in locations nearby users. Sony's FilmStation, for example, is designed to fit under a desktop, if desired, and also may be sited either horizontally or vertically for convenience.

- **HD Printing**

HD resolution is typically defined as 1920x1080 lines of resolution. Depending on the printer resolution and the size of the print media, some models are HD compatible. This means a full 1920x1080 pixel image can be printed with virtually no loss of resolution between original HD image and printed image. For example, the UP-DR80MD, with 301dpi continuous tone resolution, can print up to two full 1920x1080 HD images per 8.5x11-inch page.

- **Marketing features**

In today's competitive environment, every medical site needs to generate visibility and spread the word about its services. Medical images and reports shared with other physicians and doctors are excellent vehicles for practice promotion. Sites focusing on marketing should select printers that support high-quality image output, flexible page layouts, text and graphics combination and easy-to-file media formats to meet a referring physician's needs. A printer that automatically adds your logo to every page is also a good choice.

VI. COST OF OPERATION

When considering the price of a printing device, look at the total cost of ownership – including the cost of print cartridges and heads, special print media and related supplies, which can add extensively to the price. Do your homework—most manufacturers provide page-yield data for printing supplies in their technical specifications. Remember, the least expensive printer to purchase, in fact, may be the most expensive to operate when all overall reliability/life of product costs are considered.

Today, environmental issues are a growing concern among businesses. Examine the policies of your printing vendors. These can vary widely.

Be particularly thorough when considering ink jet printers for reports and other documents. While often extremely reasonably priced, the cartridges for these printers typically take a large bite out of a budget. Surprisingly, a dye sub printer, which offers the benefit of high quality waterproof printing, is often more economical than an ink jet in the long run.

VII. SERVICE AND WARRANTIES

Also consider the warranties that accompany printers. Some vendors include a robust agreement for parts and labor as part of the purchase package, while others require extra payment for similar coverage. Some service agreements are provided by distributors, not manufacturers-so ask.

Sony products are generally covered by a one-year parts and labor agreement with an extension option. Many medical printers from other vendors come with only a 90-day agreement for labor.

Also consider whether labor is onsite or requires shipping a printer to the manufacturer. If so, remember that large, heavy printers may be extremely difficult to pack and transport. Any time without a functioning printer will have a financial impact on a facility.

VIII. DISTRIBUTED VS. CENTRALIZED WORKFLOW

A printer may be either shared locally among a small group of users or serve a large user pool, requiring some personnel to walk to a printer bay and possibly wait for their materials. If a site has a low print volume and many users with similar printing requirements, a centralized, high-volume set-up may make the most sense. Conversely, if the type of output required varies among users, siting specialized low-volume printers nearby individual groups of users may be the best choice. In either case, sites must strike a balance between printer cost and productivity when deciding between distributed and centralized workflow.

IX. ENVIRONMENTAL CONSIDERATIONS

Today, environmental issues are a growing concern among businesses, including medical facilities. Many organizations have policies regarding not only their own environmental practices but also those of their partners and vendors. The environmental policies of electronics vendors can vary widely.

Sony relies on recycled materials whenever possible and minimizes waste in packaging and documentation throughout its product line. In all its medical products, it adheres to international guidelines restricting use of hazardous materials, such as silver-halio in medical films.

Sony products also are engineered for sustainability with energy efficient power consumption, recyclable materials and innovative technologies that maximize product performance with a minimum of environmental impact.

In addition, Sony supports programs to help end users recycle unneeded printers from all vendors and to trade in serviceable printers for new devices.

Planning a cost-effective printing solution is easy once you understand your printing profile. Investing in the features you need without paying for technology that will not benefit your site is sound planning.

X. PUTTING IT ALL TOGETHER

Planning a cost-effective, efficient printing solution is easy once you understand your printing profile. Investing in the features and functionalities you need without paying for technology that will not benefit your site is key to good planning.

Again, keep in mind that purchasing several printers for different, specialized print output may often be more cost-effective than investing in large, multi-function printers that may provide output that is not useful to your site. Multiple printers will enable you to plan distributed workflow, if desired, and will provide back up printing if another printer fails. Additionally the cost of upgrading units individually to new technologies or enhanced workflow features will be less with multiple smaller devices.

With today's lower print volumes, different departments also can pool resources to meet shared needs with a single device. For example, a versatile, high-quality color printer such as the Sony UP-D80RMD is a good all-around choice for printing in a medical environment. It can serve admirably as both a quality printer for surgical and pathology color images, as well as general text documents.

XI. CONCLUSION

The requirements for image output in a medical facility are demanding and diverse. Imaging sites would be well served to assess their complete printing needs and understand the full range of technologies available today to make the most of their printing purchases.

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