South American Journal of Nursing
Volume 1, Issue 2, 2015

A Practical Guide in Health-Care Organizations in Nigeria Today

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Abstract

Perhaps the two most often studied and empirically supported organizational factors that can promote the acceptance of technology by the end users are training and participation. The science of training is well established. Not surprisingly, well designed training programs have been shown to promote end user acceptance of technology. The key is to design the training program according to the scientific evidence. Well designed training not only transfers knowledge and skills about the technology, but it can also bring understanding of the technology through education and can create feelings of involvement in decisions. In addition, training can lead to several other important variables for the acceptance of technology including self-efficacy and intrinsic motivation. This paper reviews the theoretical knowledge on what leads to successful technology implementation and how this can be translated into specifically designed processes for successful technology change in Nigerian health-care organizations.

Key words: *Safety, information technology, patients, and health-care.*

Introduction

Evidence is emerging that certain technologies such as computerized provider order entry may reduce the likelihood of a patient harm. However, many technologies that should reduce medical errors have been abandoned because of problems with their design, their impact on workflow, and general dissatisfaction with them by end users. Patient safety researchers have therefore looked to human factors engineering for guidance on how to design technologies to be usable (easy to use) and useful (improving job performance, efficiency, and/or quality). While this is a necessary step towards improving the likelihood of end user satisfaction, it is still not sufficient. Human factors engineering research has shown that the manner in which technologies are implemented also needs to be designed carefully if benefits are to be realized. The literature on diffusion of innovations, technology acceptance, organizational justice, participative decision making, and organizational change is reviewed and strategies for promoting successful implementation are provided. Given the rapid and ever increasing pace of technology implementation in health care, it is critical for the science of technology implementation to be understood and incorporated into efforts to improve patient safety in Nigeria (Baridam, 2000)

There is a growing recognition among those concerned with quality of care and patient safety that technology, especially information technology, may hold the key to improvements. These new technologies have the potential to improve all aspects of healthcare delivery from diagnosis and treatment to administration and billing. The pace of new technology implementation in healthcare delivery has been accelerating over the years, and there is good reason to believe that this will not change in the near future because of pressures from government, purchasing groups, and consumers. This pressure seems to be having an effect. Recent estimates suggest that up to 40% of US hospitals are planning to implement electronic order entry within the next 5 years° and a 2002 ISMP survey found that 50% of the responding hospitals were considering implementing bar coding technology. With the pace of technology implementations likely to accelerate, it is imperative that healthcare delivery oranizations understand how to maximize the potential benefits of patient safety technologies (French *et al*, 2000).

Human factors engineering science which includes the study of technology design and evaluation has shown that, for technology to be used effectively (that is, in the intended manner), it must be usable (that is, easy to use) by the potential end users. Among patient safety scientists and practitioners, technology usability is becoming accepted as a necessary component of design to ensure that new technologies are used effectively; this is clear from the number of recent publications on the topic in the healthcare literature.

While there is clear evidence that, for technologies to be used effectively they must be designed to be usable (that is, easy to use) and useful (that is, will improve job performance, efficiency, and/or quality), the evidence is also clear that design does not end once usability and usefulness are addressed. The way that technology is implemented into an organization must also be designed properly to increase the probability of effective use. Studies of technology adoption and acceptance in health care are beginning to appear in the literature, which is a sign that the importance of implementation is becoming more recognized. The purpose of this paper is to present the argument that the design of technology implementation separate from usability considerations may independently determine the extent to which end users accept and use new technologies such as those designed to improve patient safety.

Understanding the Impact of New Technology on End Users

Patti & Rion (2008) is of the opinion that the effects of new technology on users, the organization, and work processes are dependent on many factors. For example, new technology will often change how jobs and tasks are accomplished, the extent of division of labour, the span of organizational control, and the degree of coordination. The changes themselves may be for the better, but they are changes nonetheless. Because so much typically does change with the introduction of new technology, employee resistance is likely may reduce or prevent the effective use of the technology(Sisk, 2011).

Resistance to change is a complex phenomenon and several theories have been proposed to explain it. Equity implementation theory suggests that users assess changes in terms of gain or loss in equity status, compare their relative outcomes with that of the organization, and compare their relative outcomes with other users. Changes perceived as being favorable for example, if the administration of bar coded medication results in faster and safer medication administration will be accepted, and changes viewed as unfavourable for example, if medication administration takes longer it will be resisted (Burke & Warner, 2001).

Attribution theory has also been used to explain end user resistance to new technology. The model posits that the introduction of new technology, the external environment, and internal interpersonal influences combine with previous success or failure with implementing new technologies to influence causal attributions. The attributions can influence expectations of what will happen during and after the implementation. This then may affect affective and behavioural reactions to the use of the new technology (Nwachukwu, 2003). In fact, there is empirical support that previous negative experiences with information technology can lead to the rejection of new systems. Taken together, the two theories posit that, if an implementation is designed such that potential end users (nurses, physicians, pharmacists, etc) believe that (a) their jobs will change for the worse, (b) their work will become worse relative to another group, (c) the organization is benefiting from the new technology at their expense, or (d) this change will be as bad as previous changes, there is an increased likelihood that end users will reject the new technology. It is therefore clear that, even if a technology is user friendly, the design of the implementation will be at least as critical in determining end user acceptance and effective use, (Oparanma & Oparanma, 2015)

The Science of Designing New Technology Implementation

Several decades of research have helped to provide empirical evidence showing what types of design practices help to create technology implementation processes that are likely to promote end user acceptance and effective use of new technologies. Major contributions come from the studies of technology acceptance, technology implementation, diffusion of innovations, organizational justice, participative decision making and technology/organizational change. Key research from these areas will be discussed to make the case that the science of implementation does, in fact, exist and should be used to design technology implementation processes.

The questions that need to be addressed first are: (1) why focus on the notion of "design"? and (2) what does it mean to design a technology implementation? The first question is central to the goal of patient safety and reflects decades of work in safety outside health care. There are two main ways to approach safety goals reactive approaches and proactive approaches. The reactive approaches are certainly most well known in health care, as was seen in a recent debate on whether to focus patient safety efforts on errors or injuries. Both approaches are primarily reactive in that data on errors or injuries must first be collected so that prevention efforts can be implemented. An entirely different approach is to be proactive and not wait for either errors or injuries, but rather to focus on making sure that existing systems are designed to prevent errors or injuries from happening in the first place (Kotter *et al* 2010). There is a well known science to such design which is known as human factors engineering. As far as the second question is concerned, design is typically thought of in terms of products (such as software, IV pumps, surgical tools) but also applies to processes. The methods by which technologies are implemented into organizations are all processes and they will either be designed well or poorly. The review of the key literature contributing to our understanding of how to design an implementation will show that process design principles and guidelines exist which can be followed to reduce the likelihood of technology rejection and increase the likelihood of acceptance.

What Predicts whether People Intend to use New Technologies?

For several reasons the literature on how to design technology implementation processes appropriately has mostly focused on one of two outcomes: (a) satisfaction with technology and (b) willingness to use the technology which is typically discussed as "technology acceptance" and/or "behavioral intention to use". The former is typically used when the technology being studied is mandatory that is, end users do not have a choice in using the technology. This is the typical situation in health care, as in the case where a hospital replaces its IV pumps with Smart IV pumps. Willingness to use the technology is used most often when the technology is voluntary that is, users have a choice to use it (for example, physicians can choose to use electronic order entry or to hand write prescriptions). These two measures are used more often than measures of actual use because it is much simpler to measure satisfaction, acceptance, or intention to use which can be measured with validated survey items than it is to measure actual use. Strong cases have been made in theories such as the theory of reasoned action, the transtheoretical model, diffusion of innovations, and the theory of planned behaviour that the best predictor of actual behaviour is behavioural intentions, suggesting that the more simple to measure construct of behavioural intention or acceptance might be a reasonable proxy measure of actual use in voluntary environments. In environments where the use of a particular technology is mandatory for example, the replacement of paper records with electronic medical records satisfaction with technology is thought to be related to performance with the technology. An important question to answer for understanding how to design technology implementation processes is therefore what affects technology acceptance or satisfaction? These factors should illuminate design criteria for implementation processes.

Organizational Factors

Organizational factors that have been found to predict end user technology acceptance focus on decisions made by management related to how a new technology will be implemented. One such factor is how well the new technology will be integrated with existing technologies, workflow, the environment, and other social systems. For example, if a hospital plans to implement electronic order entry, there will be integration issues related to medical records, pharmacy information systems, current methods of ordering and dispensing medications, space for computer terminals, lighting, and workflow. Technical system changes cannot be designed in isolation from the subsystems involving humans, and technical systems must fit within the constraints of the environment. What that means is that, if a new technology does not work well with other existing technologies end users must use, is not usable in the existing environment (for example, lack of space or lighting causes glare), or does not positively impact workflow, resistance to the new technology is likely (Tushman & Romanelli, 2012).

Management commitment to the new technology and the implementation process has also been found to be an important predictor of the success of the change. This commitment needs to be shown through specific actions. For example, the reason(s) for the new technology should be made clear in order to reduce uncertainty about the necessity of the new technology and to foster positive attitudes toward the technology. Clarity in the reasons for the new technology also facilitates the development of measures of success as well as accountability for the change (Scott, 2010).

MaClayton, (2005) believes that another indicator of management commitment and good planning is the presence of a structured program for implementation. A structured program might take a variety of forms including a multidisciplinary transition team, clear direction for end users and managers as to where to go for help, and structured communication networks between supervisors and workers to deal with the new technology. A well designed structure indicates that the organization is ready for the change to the new technology, which may serve to reduce the likelihood of resistance.

Some Ways that Information Technology can Reduce Errors

Information technology can reduce the rate of errors in three ways; by preventing errors and adverse events, by facilitating a more rapid response after an adverse event has occurred, and by tracking and providing feedback about adverse events. Tilles (2000), opined that data now show that information technology can reduce the frequency of errors of different types and probably the frequency of associated adverse events. The main classes of strategies for preventing errors and adverse events include tools that can improve communication, make knowledge more readily accessible, require key pieces of information (such as the dose of a drug), assist with calculations, perform checks in real time, assist with monitoring, and provide decision support.

Improving Communication

Failures of communication, particularly those that result from inadequate “handoffs” between clinicians, remain among the most common factors contributing to the occurrence of adverse events. In one study, cross-coverage of medical inpatients was associated with an increase by a factor of 5.2 in the risk of an adverse event. A new generation of technology - including computerized coverage systems for signing out, hand-held personal digital assistants, and wireless access to electronic medical records may improve the exchange of information, especially if links between various applications and a common clinical data base are in place, since many errors result from inadequate access to clinical data. In the study mentioned above, the implementation of a “coverage list” application, which standardized the information

exchanged among clinicians, eliminated the excess risk resulting from cross-coverage (Burke & Ogwo, 2008).

Also, many serious laboratory abnormalities for example, hypokalemia and a decreasing hematocrit - require urgent action but occur relatively infrequently, often when a clinician is not at hand, and such results can be buried among less critical data. Information systems can identify and rapidly communicate these problems to clinicians automatically, unlike traditional systems in which such results are communicated to a clerk for the unit. In one controlled trial, this approach reduced the time to the administration of appropriate treatment by 11 percent and reduced the duration of dangerous conditions in patients by 29 percent.

Providing Access to Information

Another key to improving safety will be improving access to reference information. A wide range of textbooks, references on drugs, and tools for managing infectious disease, as well as access to the Medline data base, are already available for desktop and even hand-held computers. Ease and rapidity of use at the point of care were initially problematic but appear to be improving, and hand-held devices are now widely used, especially for drug-reference information.

Summary

Health care is growing increasingly complex, and most clinical research focuses on new approaches to diagnosis and treatment. In contrast, relatively little effort has been targeted at the perfection of operational systems, which are partly responsible for the well-documented problems with medical safety. If medicine is to achieve major gains in quality, it must be transformed, and information technology will play a key part, especially with respect to safety.

In other industries, information technology has made possible what has been called “mass customization” the efficient and reliable production of goods and services according to the highly personalized needs of individual customers. Computer retailers, for example, now use their Web sites to allow people to purchase computers built to their exact specifications, which can be shipped within two days. Medical care is, of course, orders of magnitude more complex than selling personal computers, and clinicians have always strived to provide carefully individualized care. However, safe care now requires a degree of individualization that is becoming unimaginable without computerized decision support. For example, computer systems can instantaneously identify interactions among a patient’s medications. Even today, more than 600 drugs require adjustment of doses for multiple levels of renal dysfunction, a task that is poorly performed by human prescribers without assistance but can be done accurately by computers. Multiple studies now demonstrate that computer-based decision support can improve physicians’ performance and, in some instances, patient outcomes.

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