Preinstallation hurdles and postinstallation benefits of biometric access control system (BACS) in a government hospital mess

Nafis Faizi, Mohd Tabish Khan, Mohd Najmul Aqib Khan, Istiyaq Ahmad

Department of Community Medicine, J.N. Medical College and Hospital, Aligarh, Uttar Pradesh, India.
Correspondence to: Nafis Faizi, E-mail: nafisfaizi@gmail.com

Abstract

Background: The risk of violence against doctors working in a government hospital is a known phenomenon. The duty rooms and doctors' mess in hospital premises are the soft and easy targets for these incidences. To provide a stress-free work environment and better security and privacy, a fingerprint-based biometric access control system (BACS) was installed in the doctors' mess at J.N. Medical College and Hospital, Aligarh.

Objective: To identify the preinstallation hurdles and postinstallation benefits of a BACS in the doctor's mess.

Materials and Methods: This was a cross-sectional study conducted in the J.N. Medical College and Hospital, A.M.U., Aligarh, Uttar Pradesh, India. The study population consisted of the members of the Resident Doctors Association (RDA) and the staff and members in charge of the RDA mess. The study was conducted in two phases through different questionnaires—phase A: to assess the main hurdles in the installation of BACS, and phase B: to assess the perception of benefits of BACS installation.

Result: The main hurdle was organizational challenges (47%) including consensus building and affordability, followed by operational (29%), and user-based challenges (24%). The main benefits perceived by the members of the mess were restriction of entry of the patients and attendants (44.2%) and influential outsiders (37.2%), followed by a better sense of privacy and security (10.4%) and restriction in free flow of infections from wards through the attendants (8.2%). The staff workers reported a positive change in the work atmosphere with a reduction in rude and intimidating behavior against them and improvement in service, delivery time, and quality.

Conclusion: The BACS is a cost-effective solution for security, although not a foolproof solution. Apart from security, it has other benefits, and if linked with attendance systems, it can find a solution to the problem of ghost doctors in medical colleges and rural health facilities.

KEY WORDS: Biometric, violence, security, infections, ghost workers

Introduction

The risk of violence against doctors in their work environment is not a new phenomenon,[1] and in the recent years, incidences of violence against doctors have increased in India. The Indian Medical Academy reports that over 75% of doctors have faced violence of one or the other kind at work, mostly by the relatives or attendants of the patients.[2] This is despite the fact that many of the minor incidents go unnoticed and unreported. Elsewhere in the world, long waiting times, shorter appointment times, and suspicion of expensive investigations that are not necessarily needed are the main reasons for this violence.[3] Media revelations of poor practice and of questionable relationships between some doctors and industry further inflames these attitudes.[3] Considering the dearth of doctors and facilities for specialized care in tertiary hospitals in India, many of these reasons already exist at a very discomforting level. The patient load is

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2015.20062015316	

very high, including the load in the OPDs, the IPDs, and the emergencies. The doctors in these busy work environments are frequently under additional stress arising due to the fear of violence. Many medical organizations in India, therefore, declare that medicine is a "dangerous" profession and that doctors should be provided security.[4]

A hospital is a place where the attendants accompanying their patients are very worried, and their spirit of urgency sometimes leads to altercations with the guards and authorities. Many a time, they cannot handle the state of their patients very well and are very anxious. The hospitals have a strict no entry zone at some intensive units and aseptic zones, and there is hardly any facility for consoling the distraught attendant when their patients have to be suddenly shifted to these zones for emergency care. Every now and then, this becomes a potential source of chaos and, sometimes, violence. Apart from the accompanying attendants, the practice of visiting relatives, friends, and acquaintances while they are in hospital is considered a sociable and thoughtful act[5] and is a common practice not only in India but also in China and Taiwan.[6] Every hospital has certain rules and regulations regarding the number of attendants permissible for each admitted patient, bedside rules, and fixed visiting hours but is very difficult to enforce strictly in the government hospital settings. In addition, the attendants are a source of infection besides being a source of additional chaos, disturbance, and physical violence in the hospital.[7] The problem of free flow of attendants and inadequate security restrictions can lead to transmission of infections from the wards to the relatively noninfectious places in the hospital such as dining halls, kitchen, and other places.

A pragmatic solution for the provision of adequate security is very difficult for the government hospitals, as they have very limited budgets. More often than not, the chief medical superintendents try their best to provide adequate security but fall short owing to their financial limitations. The duty rooms and doctors' mess situated inside the hospital for the doctors on duty are easy targets for the violent or agitated attendants. The doctors' mess, where this study was conducted, is one such place where the fear of violence is high. Under these circumstances, a decision to install a biometric access control system (BACS) at the doctors' mess situated in the college hospital was taken.

Biometrics is defined as distinguishable (rather than unique), physiological, and behavioral traits that may be used for identification and authentication.[8] Unlike credentials-based systems using documents and PIN, biometric traits (e.g., fingerprint, face, and iris) cannot be lost, stolen, or easily forged; they are also considered to be persistent and unique.[9] In addition, the automated gates that are equipped with BACS restrict the free flow of influential outsiders and visitors who cannot be otherwise stopped by ordinary guards and personnel. Although the biometrics is a promising technology for improving security, they can only do so if they overcome significant technical and social challenges including the organizational, operational, and user-based challenges.[10]

The direct costs of implementing BACS are immediate, tangible, and measurable but the benefits are qualitative, longer term, and difficult to estimate monetarily.[11] This disparity confounds value assessment and financial feasibility analysis, increasing the challenge of communicating the relative advantage of the technology and slowing its diffusion.[11]

There are very few government hospitals with BACS in India, and many of these installation projects are stalled owing to the preinstallation challenges of affordability and acceptability from both organizational and operational points of view. Driven by the aforementioned concerns, this study was devised with the objective of identifying the preinstallation hurdles and postinstallation benefits of a BACS in the doctors' mess at J.N. Medical College and Hospital, A.M.U., Aligarh.

Materials and Methods

This was a cross-sectional study conducted in the J.N. Medical College and Hospital, A.M.U., Aligarh, Uttar Pradesh, India. The study population consisted of the members of the Resident Doctors Association (RDA) and the staffs and members in charge of the RDA mess. The mess is for the resident doctors of the hospital, and all of them are the members of the RDA. The association has almost 700 members with about 30 elected members acting as executive and advisory members, including the chairholders.

The study was conducted in two phases:

- Phase A: to assess the main hurdles in the installation of BACS and
- Phase B: to assess the perception of benefits of BACS installation.

Study Duration and Plan of the Study

Phase A was conducted during March to May, 2014, just before the installation of BACS. The main hurdles during the pre-BACS installation were identified through a questionnaire based on, but not limited to, the possible challenges and caveats identified by Chandra and Calderon[10] Because the decision making body of the RDA consists only of advisory and executive committee members, this step was conducted only among these 30 members.

Phase B was conducted during May–June, 2015, to find out the benefits of the BACS installation. The study was deliberately conducted during May–June, 2015, many months after the installation, to let the initial euphoria settle down and allow the smooth functioning of BACS. This step was conducted in two different sets of populations. The perception of benefits of BACS was ascertained through another questionnaire among (1) the registered members of RDA and (2) the staffs and workers of the RDA mess. The timeline and plan of the study is given in detail in the Figure 1. A written consent was taken from each participant and full confidentiality of the responses was insured and maintained throughout the study. The study was approved by the association's
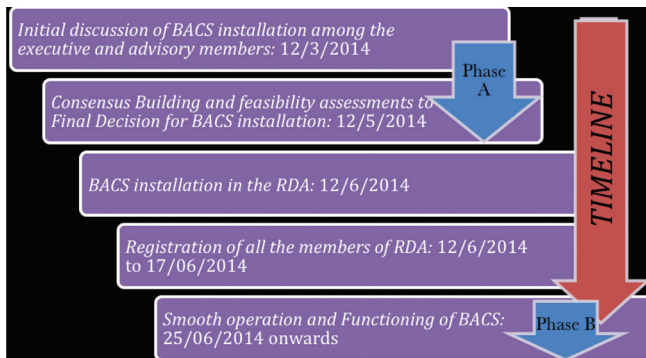
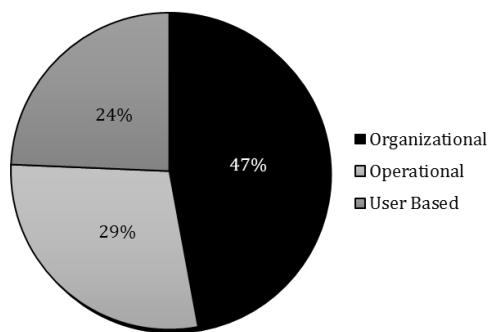**Figure 1:** Timeline of BACS installation and plan of study.

Figure 2: The main types of hurdles faced during BACS installation.

ethics committee.

Thus, the study sample consisted of 30 subjects who were interviewed in phase A of the study and 550 subjects in phase B, including 500 members and 50 staff workers of RDA mess. The data management and analysis was done by Microsoft Excel, 2011 version.

Result

The preinstallation hurdles were studied among the advisory and executive committee members, and the main hurdles were identified under three main types of challenges: organizational, operational, and user-based challenges. Multiple options were allowed to get a clear idea of all the hurdles mentioned by the participants. The main type of hurdle was found to be organizational at 47% (89/189), followed by operational (29%, 54/189) and user-based challenges (24%, 46/189) [Figure 2]. Among the organizational challenges, getting a consensus for BACS installation among the fellow advisory and executive members was considered the main hurdle (80.0%), followed by affordability

and cost-related concerns (73.3%) and others. The problem of registration within a stipulated time frame was the main operational hurdle (70.0%), considering the fact that the members had different duty timings and almost 40% of new members join every year. The other operational hurdles were the fear of inefficiency of BACS and technical difficulties, among others. Acceptability issues, especially among staff workers, were the most common user-based challenge (43.3%), mostly because of the awe and amazement associated with this new technology. User trust and confidence (36.6%) and unnecessary intrusion of privacy (23.3%) were the other concerns. The details of the main hurdles during the BACS installation are given in Table 1.

In phase B of the study, the members of the mess and staff workers were asked about the benefits of BACS installation. The members were asked to rate the main benefit of the BACS on the mess facilities. Restriction in the entry of the patients and attendants was reported as the main benefit by 44.2% (221/500) of the members, followed by the restriction of influential outsiders by 37.2% (186/500) and others [Figure 3].

The perception of benefits and the satisfaction level was also studied among the members. More than 50% of the members were satisfied with the BACS acting as a severe deterrent to patients, attendants, and influential outsiders' entry. A majority of the members also reported satisfaction with the reduction in untoward incidents, a better perception of security and privacy, and restriction in free flow of infections to the hospital mess from the wards [Table 2].

The changes in work environment after BACS installation as perceived by mess staff were also assessed to find out the benefits of BACS to the workers. A majority of the workers reported that the atmosphere had become more amicable and there was a decrease in work stress owing to reduction in incidents of rude and intimidating behavior shown by the outsiders (52%), who they had to serve unwillingly owing to pressure [Table 3].

Discussion

This study was devised to find out the preinstallation hurdles of BACS and the benefits of BACS installation. The organizational challenges were found to be the most important hurdle (47%), followed by technical and user-based hurdles. Among all the types of hurdles, getting a consensus among the advisory and executive members was found to be a significant hurdle (80%), apart from affordability and cost-related concerns (73.3%), hurdles in registration within a time frame (70.%), acceptability issues (43.3%), and others including privacy concerns.

Diffusion of innovations and acceptability of change is a difficult phenomenon, especially in a democratically functioning body as in this case. The organizational hurdles found in this research were similar to the previous studies.[10] After a consensus among the advisory and executive members, the budget constraints and the operational and tech-

Table 1: The main hurdles during BACS installation

Type of hurdle	N (no. of responses)	%
Organizational challenges (*n* = 30)		
Getting a consensus for BACS installation	24	80.0
Affordability and cost-related concerns	22	73.3
Getting a suitable service provider	20	66.6
External pressure from influential outsiders against BACS installation	18	60.0
Lack of reports and analysis on credibility of BACS from similar settings	5	16.0
Operational challenges (*n* = 30)		
Problem of registration within a stipulated time frame	21	70.0
Fear of inefficiency or cost-ineffectiveness	13	43.3
Fear of technical difficulties during operation	11	36.6
Maintenance costs	6	20.0
Speed and efficiency during peak hours	3	10.0
User-based challenges (*n* = 30)		
Acceptability issues (especially among staffs)	13	43.3
User trust and confidence	11	36.6
BACS is an attempt to shift focus from the relevant demands of plausible solutions by the authorities	9	30.0
Unnecessary intrusion of privacy	7	23.3
Concerns over BACS being an improper use of monitory contributions to the organization	6	20.0
Total number of responses	189	
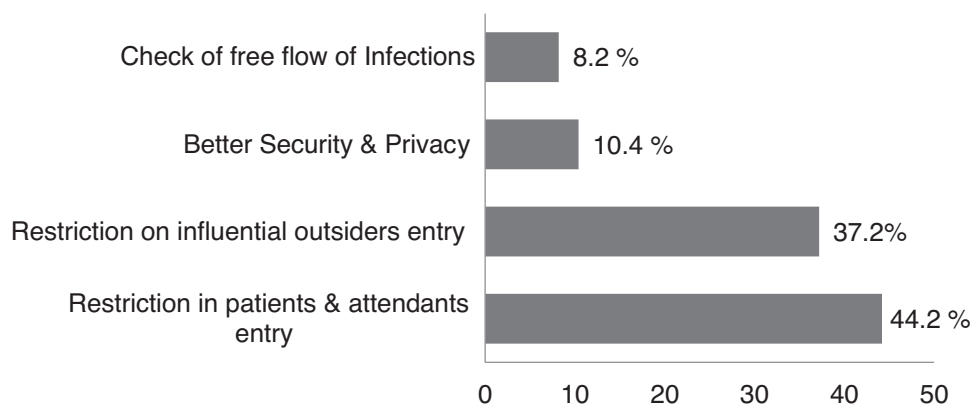
Figure 3: Main benefits of BACS.

nical issues became a challenge for the installation. After a direct assessment of cost of BACS installation by the service provider, it was found that a BACS based on fingerprint matching with a biometric entry gate was available at a very affordable price. A fingerprint-matching biometrics is the most popular form of biometrics these days, because of their low price.[12] The sociocultural concerns and technical and operational issues have also been found in other studies.[13] The concerns on privacy and other legal issues have also been a prominent challenge in the other studies,[14–16] although, in this study, there were no legal issues or challenges put forward by

any of the members.

The concerns on unnecessary privacy intrusion were quoted time and again by a few members under the influence of outsiders from both within the hospital staffs and outside. Surprisingly, a few members went ahead and even likened it to a "Big Brother" situation! These were quashed by consensus statements by the advisory and executive members explaining the importance of the biometric system for a healthy functioning of the hospital and giving privacy to the resident doctors, creating a better work environment, and highlighting the futility of the Big Brother concern, as closed

Table 2: Benefits of BACS as perceived by the members

Benefits	Type of response	*n*	%
Patients and attendants entry restrictions	Satisfactory	388	77.6
	Unsatisfactory	83	16.6
	Neutral	29	5.8
	Total	500	100
Decrease in the untoward incidents	Satisfactory	349	69.8
	Unsatisfactory	125	25
	Neutral	26	5.2
	Total	500	100
Perception of security and privacy	Satisfactory	298	59.6
	Unsatisfactory	161	32.2
	Neutral	41	8.2
	Total	500	100
Influential outsiders entry restrictions	Satisfactory	328	65.6
	Unsatisfactory	141	28.2
	Neutral	31	6.2
	Total	500	100
Has BACS restricted free flow of infections?	Yes	348	69.6
	No	152	30.4
	Total	500	100

Table 3: Changes in work environment after BACS installation

Change in work environment	*n*	%
Decrease in work stress owing to reduction in incidence of rude and intimidating behavior by outsiders	26	52
Improvement in service time and quality	16	32
Reduction in instances of agitated, rough, or rude behavior by members owing to delay in service	7	14
Reduction in account discrepancies owing to forced credits	1	2
Total	50	100

circuit television (CCTV) cameras were already installed by the authorities at every nook and corner without any difficulties and any similar concerns raised by anyone. In addition, the noninvasiveness and convenience of biometrics make it a better alternative than the other more costly alternatives such as frisking and credentials-based checking.

The benefits of the BACS system was assessed in this study through the benefits perceived by the members and through the improvements in the work environment reported by the staff workers. The BACS was found to be a hassle-free and easy deterrent for the outsiders and attendants. The main benefit was the restricted entry of patient attendants (44.2%) and outsiders (37.2%), followed by better security and privacy (10.4%) and limitation of transmission of infections from wards to the mess by the attendants (8.2%).

Biometrics is an excellent choice for entry restrictions as, *people can lie but, as yet, their physiology cannot*.[17] The biometrics have been considered more beneficial than any other technologies for security restrictions similar to the benefits found in our study.[18] Moreover, in the low-resource settings, most of the people get too overwhelmed and awed by the new technology and simply turn away from trying to enter the a biometric-enabled access, as in this case. By a restriction of free flow of patients and attendants from the wards, the members felt that it does serve as a limited but significant source of infection control considering the high prevalence of infections[7] and the low rates of handwashing among the attendants. The BACS also led to a betterment of the work environment, by reducing the unnecessary workload and improvement in service quality and even decreasing the instances of rough and rude behavior toward the workers. Owing to the effectiveness of BACS, hospitals are now employing more and more of biometrics and other technologies to solve the problem of vandalism and violence, together with other beneficial uses of biometrics in patient care.[19]

Strength and Limitations

This is the first study in the government hospitals in India that analyzed the hurdles in the installation of a BACS and the benefits after installation. With a substantial sample size

in a governmental setup, this study argues in favor of the BACS as a solution for violence against doctors, primarily because of its affordability and ease and other notable benefits. However, there are some significant hurdles that have to be taken care of before taking the decision to install BACS.

This study has certain limitations as well. The study is based on subjective assessment of the hurdles and is bound to be affected by a reporting bias. The study is difficult to generalize, given the specific context in which it has been studied. The assessments of the benefits of BACS in this study are actually a perception and not objectively measured benefits.

Conclusion

The BACS is not a foolproof security solution for the hospitals but can serve as a severe deterrent against the free flow of outsiders in a government hospital. The corporate hospitals already use this technology for smooth functioning of their hospitals, in spite of the fact that they have better security system in the form of armed guards and other security personnel. The government hospital setups should open up to this new technology as it is cost-effective and easy to install, as we have seen in this study. The only concern in this ordinary type of finger-matching BACS system is that as soon as the gates open up after biometric identification, there is a lag phase before the gates are sealed again, and this lag may create an opportunity for an imposter to quickly sneak in.

There are other potential uses of a biometric system as it can be attached to an attendance system, and this can serve as an effective solution to the significant problem of ghost workers in the rural health care in India.[20] The BACS system is already present in some of the private medical colleges for student attendances. Linking the biometric system to a permanent database can also check the increasing number of ghost teachers, part-time teachers, and visiting teachers in the private medical colleges in the country, given the huge number of such fraudulent practices prevalent in the country.[21]

References

1. Health Services Advisory Committee. *Violence to Staff in the Health Services.* Health and Safety Commission. London: HMSO, 1987.
2. Dey S. Over 75% of doctors have faced violence at work, study finds. *The Times of India.* May 4, 2015. Available at: http://timesofindia.indiatimes.com/india/Over-75-of-doctors-have-faced-violence-at-work-study-finds/articleshow/47143806.cms (last accessed on 16th June, 2015).
3. Editorial. Violence against doctors: Why China? Why now? What next? Lancet 2014;383:1013.
4. Nagral S. Doctors and violence. Indian J Med Ethics 2001;9(4):39.
5. Satpathy S, Sharma RK. A study of hospital visitors' policy in a large tertiary care superspeciality hospital. Indian J Community Med 1999;34:158–66.
6. Tzeng HM, Yin CY, Tsai SL, Lin S, Yin TJ. Patient falls and open visiting hours: A case study in a Taiwanese medical center. J Nurs Care Qual 2007;22(2):145–51.
7. Zulfiqar B, Salam A, Firoz M, Fatima H, Aziz S. Effects of inflow of inpatients attendants at a tertiary care hospital—A study at civil hospital Karachi. J Pak Med Assoc 2013;63(1):143–7.
8. Matyas SM, Stapleton J. A biometric standard for information management and security. Comput Security 2000;19(5):428–41.
9. Jain AK, Kumar A. Biometrics of next generation: an overview. In: *Second Generation Biometrics*, Mordini E, Tzovaras D (Eds.). New York, NY: Springer, 2010.
10. Chandra A, Calderon T. Challenges and constraints to the diffusion of biometrics in information systems. Commun ACM 2005;48(12):101–6.
11. Rogers EM. *Diffusion of Innovations.* New York, NY: The Free Press, 2003. pp.453.
12. Building the business case for Biometrics*. Raconteur.* 2015; Available at: http://raconteur.net/technology/building-the-business-case-for-biometrics (last accessed on 16th June, 2015).
13. Woodward JD, Webb KW, Newton EM, Bradley MA, Rubenson D, Larson K, et al. *Army Biometric Applications—Identifying and Addressing Sociocultural Concerns.* Pittsburgh: RAND, 2001. p. 185.
14. Agre PE, Rotenberg M. *Technology and Privacy: The New Landscape.* Massachusetts, MA: Cambridge, 1998.
15. Ries AS. Comment: America's anti-hijacking campaign—Will it conform to our constitution? N C J Law Tech 2001;3(1):123–50.
16. Sutrop M. Ethical issues in governing biometrics technologies, ethics and policy of biometrics. Lect Notes Comput Sci 2010;6005:102–14.
17. Matthews D. Biometrics get to work as public fears subside. *Raconteur*, 2015. Available at: http://raconteur.net/technology/biometrics-gets-to-work-as-public-fears-subside (last accessed on 16th June, 2015).
18. Riecherd J. *Benefits of Biometric Machines. Selfgrowth.com,* 2015. Available at: http://www.selfgrowth.com/articles/benefits-of-biometric-machines (last accessed on 16th June, 2015).
19. Meyer H. *2011 Hospital Security Survey.* Health Facilities Management, 2011. Available at: http://www.hfmmagazine.com/display/HFM-news-article.dhtml?dcrPath=/templatedata/HF_Common/NewsArticle/data/HFM/Magazine/2011/Oct/1011HFM_FEA_survey (last accessed on 16th June, 2015).
20. Bajpai N, Goyal S. Primary health care in India: Coverage and quality issues. 2004. Available at: http://globalcenters.columbia.edu/mumbai/files/globalcenters_mumbai/3.bajpai_primaryhealth_2004_15.pdf (last accessed on 16th June, 2015).
21. Kanwar S, Gyanesh A. 400 ghost teachers in private medical colleges in Punjab. *The Times of India.* March 17, 2015; Available at: http://timesofindia.indiatimes.com/india/400-ghost-teachers-in-private-medical-colleges-in-Punjab/articleshow/46591066.cms (last accessed on 16th June, 2015).