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Structured Observations and Interventions by Infection Control Practitioners: A One Year Prospective Study

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ABSTRACT

Background: One major responsibility of Infection Control and Prevention (ICP) Practitioners is rounding through in-patient departments, observing and providing feedback.

Aim: To facilitate structured observation and intervention, we adopted detailed checklists for eight major ICP targets.

Methods: Data were entered daily and analyzed quarterly for an entire year (July 2021-June 2022).

Results:

1. Screening for CRE was performed on admission in 224 patients and weekly in 180 patients, constituting 85% and 86%, respectively, of all candidates who should have been screened.
2. Seven aspects of urinary catheter management were evaluated in 452 patients, of which 2 were adequate (>99% adherence).
3. Cleaning was assessed with the ATP test. Of a total of 308 obtained samples, high (>45) levels, indicating inadequate cleaning, were detected from various bedside items.
4. 45/528 assessed peripheral IV catheters (9%) were >72 hours in place, the upper allowed limit in our hospital.
5. 7/11 items assessing isolation procedures in 284 patients were found adequate.
6. 7/11 items assessing safe injection procedures in 247 patients were found adequate.
7. 44/62 item ICP checklist evaluated in 112 surgical procedures, were found adequate, the remaining 18 showed inadequate adherence (2%-77%).
8. Of 78 mechanically ventilated patients, 8/10 ICP assessed items were according to guidelines. For most items significant differences were found between departments ($p<0.001$).

Conclusion: This one year prospective study helped identify a large range of items of ICP guidelines, which were consistently adhered to allowing their subsequent deletion from routine surveillance (and transferal for infrequent surveillance only).

Keywords: Infection control; Hospital epidemiology; Infection control practitioners; Infection control measures; Guideline adherence; Bundle approach

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HIGHLIGHTS

- To facilitate structured observation and intervention, we adopted detailed checklists for eight major targets (with 111 items) of infection control and prevention (ICP).
- Guideline adherence was assessed for 2471 patients and data entered daily and analyzed quarterly for an entire year
- Guideline adherence was 67.5% ± 19.5 (mean ± SD); 68/111 guideline items were consistently adhered to (>99%), allowing their reassignment for infrequent observation and directing ICP attention to the remaining, inadequately adhered to items.

INTRODUCTION

Management of hospital acquired infections as a specialty has come a long way since the days of Semmelweis [1] and Snow [2] and even since the land mark study of Haley, defining and quantifying nosocomial infections [3,4]. Nonetheless, the organization and management of infection control practices continues to be an issue of on-going debate and development [5-11], driven mainly by concern for outcome and cost-effectiveness [12,13]. We pioneered a departmental monthly report card, engaging the nursing staff of in-patient departments which led to improved outcome markers in several but not all evaluated fields [14]. However, like similar interventions, the continuation of the report card program proved challenging during real life as opposed to study conditions. The organization of a Health Ministry based national infection control and prevention unit in 2006, which issues guidelines and demands adherence to guidelines in combination with mandated reporting of clinical and laboratory data, led to a revolution in infection control practices and to improved outcome measures [15-21].

One major component of the responsibilities of Infection Control Practitioners (ICP) is rounding through in-patient departments, observing and providing on the spot feedback and guidance [22-26]. To facilitate structured observation and intervention, the national unit for infection control and prevention developed and distributed detailed checklists for several major targets of infection control. The adoption of the latter guidelines into routine clinical practices by the ICPs led, on the one hand, to structured and unified performance, accompanied by improved satisfaction by the ICPs themselves; while, on the other hand, it allowed for clean and accurate data collection and analysis. The current paper presents data from the first year of this project. One major result of the analyzed data is that it allowed identification of multiple components of the guidelines which were consistently adhered to completely and allowed targeting of the latter for infrequent surveillance only, thus allowing a redirection of the ICPs time and efforts to improve less well adhered to guideline components.

METHODS

This study was conducted in Shaare Zedek Medical Center, a 1000 bed general and university affiliated hospital in Jerusalem. The hospital provides all medical, surgical, pediatric and gynecologic and obstetric services and subspecialties. Autologous and allogeneic bone stem transplantations are performed, but no solid organ transplantations. The following intensive care units are active: General surgical and medical intensive care (14 beds), cardiac (10 beds), pediatric (6 beds), neurosurgical (4 beds), cardiac surgery (4 beds) and neonatal (15 beds). The infection control and prevention unit includes two infectious disease specialists, one serves as a director, and seven infection control practitioners (ICP), three of whom at 50% employment. The ICPs are all registered nurses who have completed a national, Ministry of Health sponsored, 9 month infection control and prevention program and passed a license providing examination.

Infection Control and Prevention is coordinated in Israel by the Israel Ministry of Health *via* the National Infection Control and Prevention Unit. The latter unit issues national guidelines and obligates the various hospitals to regularly report data and figures on a large range of issues, such as bacteremias, urinary tract infections, multi-drug resistant organisms, ventilator associated pneumonia, surgical site infections, use of antimicrobial etc. This Unit provides regular reports with data comparing the various hospitals across the reported issues.

Following the publication of infection control and prevention checklists for a range of issues, our hospital adopted these checklists both for streamlining the clinical practice of the ICPs and the collection of measurable data. The various clinical areas for surveillances were divided between the ICPs, for the entire year of the study. Nonetheless, during vacations and illnesses the nurses would cover for each other.

The current paper reports on the summarized data from the first year. The checklists were used during routine clinical work, regarding the following eight infection control components:

1. Screening for carbapenem-resistant *Enterobacterales*
2. Appropriate management of urinary catheters
3. Adequate cleaning of the patients' environment
4. Appropriate management of peripheral intravenous catheters
5. Adherence to guidelines regarding patient isolation
6. Safe injection procedures
7. Appropriate behaviour in the operating theaters
8. Mechanical ventilation.

Data were entered on a daily basis by the ICPs into an Excel application, based on the mentioned checklists. The χ^2 test as well as the Fisher's exact test was applied to test the association between two qualitative variables. We used the Student t test for the comparison of quantitative variables between two independent groups. The association between two quantitative was calculated using the Pearson correlation coefficient. All statistical tests applied were two tailed, and a $p<0.05$ was considered statistically significant.

Ethical Considerations

The study was conducted as part of the ICP Unit's routine activ-

ities and accordingly no informed consent was required by the hospital Internal Review Board (Helsinki Committee).

RESULTS

To facilitate structured observation and intervention and data collection, the Israeli Health Ministry checklists were adopted for eight major targets of infection control: A separate protocol was used for evaluation of central line associated bloodstream infection and results were not included in this report.

Screening for Carbapenem Resistant Enterobacteriales (CRE) was performed on admission in 224 patients and weekly in 180 patients, who constituted 85% and 86%, respectively, of all candidates who should have been screened (**Table 1**). There were significant differences in rates between the departments (58 ± 40 in pediatrics, 93 ± 20 in Intensive Care Unit, ICU, p<0.001). **Figure 1** shows that adherence to obtaining screening cultures on admission increased over the quartiles, whereas adherence to weekly screening decreased overtime; these changes, however, were not statistically significant.

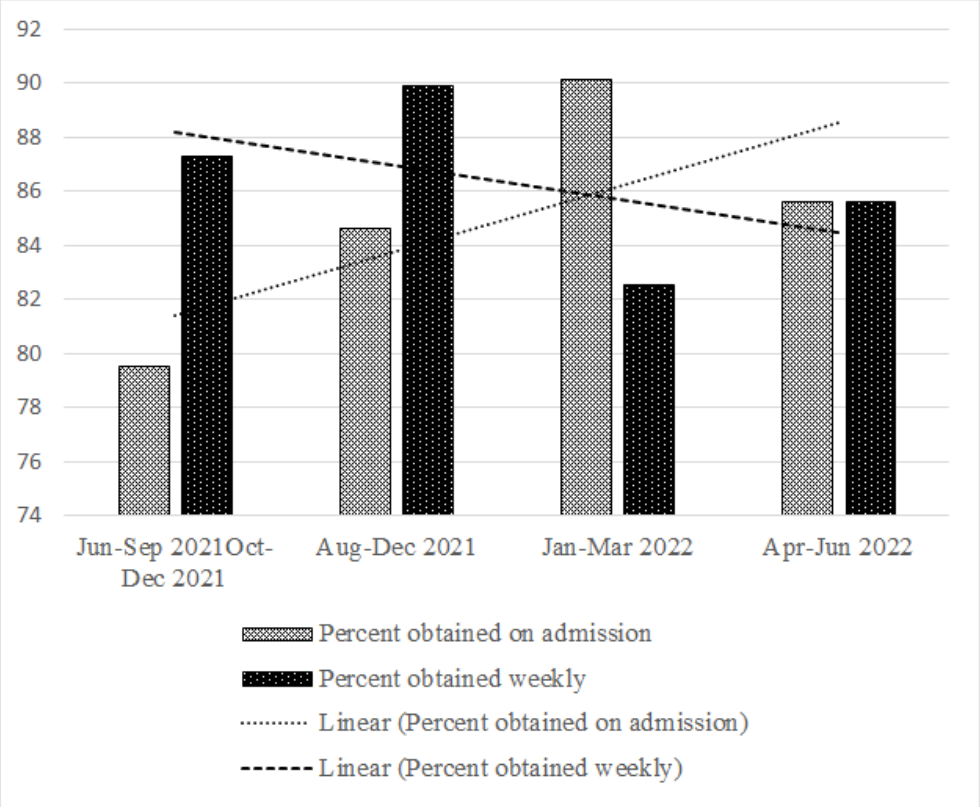

Figure 1: Percent of surveillance cultures for CPE, obtained on admission and weekly, by quartile.

Table 1: Screening for CPE carriage.

Wing	No. of screened patients, n (%) (%range/quartile)[1]	% of appropriately screened patients on admission N=224	% of appropriately weekly screened patients N=180
Internal Medicine	93 (40%) (17-30)	87 ± 20	87 ± 20
Surgery	72 (31%) (13-23)	83 ± 28	84 ± 25
Intensive Care Unit	53 (23%) (10-17)	93 ± 20	91 ± 17
Pediatrics	12 (5%) (2-4)	58 ± 40	79 ± 29
Out-patient clinics	3 (1%) (0-3)	-	
Total	233 (100%)	85 ± 26 (79-90)	86 ± 22 (82-90)
P value[2]		<0.001	0.159

1. The differences across the quartiles were statistically insignificant (95% CI 81.6-88.4, p=0.219 for screening on admission and 95%CI 83.2-89.6, p=0.517 for weekly admission).
2. Performed interventions: Interaction with a nurse (17, 7%), individual discussion (4, 2%), teaching session (3, 1%), letter (1, 0%).

Seven aspects of management of urinary Catheters (UC) were evaluated in 452 patients (Table 2), of which two were impeccable (>99% adherence with guidelines): A closed drainage system and the drainage bag were below pelvis' level. Five items required improvement as shown, with a range of inadequate adherence ranging from 5% (an absence of recorded dates of insertion and removal of the UC) to 17% (the UC was not securely attached to the patient's leg). We observed a statistically significant difference between the various departments only for one item: The lack of daily recording of the indication for the continued presence of the UC (p=0.004).

Table 2: Inappropriate management of Urinary Catheter (UC), n (%).

Wing	No of screened catheterized patients (n) (%range/quartile)[1,2]	Date of insertion & removal not recorded, %	Lack of daily recording of need for UC, %	Lack of daily recording of indication for UC[2], %	Urine collection bag is on the floor, %	The UC is not securely attached[4,5], %
		N=452	N=435	N=448	N=465	N=458
Medicine	203 (35-58)	14 (7)	19 (10)	28 (14)	25 (12)	39 (20)
Surgery	132 (23-40)	3 (2)	6 (5)	7 (5)	13 (10)	23 (17)
ICU	116 (18-43)	5 (4)	4 (4)	6 (6)	6 (5)	13 (12)
Ob&Gyn	10 (1-4)	0	0 (0)	0	1 (10)	1 (10)
Pediatrics	5 (1-2)	2 (40)	1 (25)	2 (40)	2 (40)	0
Total	457 (76-147)	24 (5)	30 (7)	43 (10)	47 (10)	76 (17)
P value[3]		0.251	0.091	0.004	0.238	0.302

1. Morning shifts 457 (76-147), evening shifts 8 (0-4).
2. The differences across the quartiles were statistically insignificant (p<0.05).
3. The differences between the departments were not statistically significant except for the lack of daily recording of the indication for the continued use of the urinary catheter (p=0.004).
4. Other evaluated items: Closed drainage system 99.6% (455/457); drainage bag below pelvis level (99% (451/457).
5.Interventions: positive feedback (134, 29%), guidance (94, 20%), meeting with head nurse (19, 4%), letter (9, 2%).

Cleaning is the basis for infection control. In clinical practice we currently use two objective measures to evaluate cleanliness, mainly after housekeeping personnel have completed cleaning: ATP and the fluorescence test. For this study, we included the ATP test results only (Table 3). Of a total of 308 obtained ATP samples, high (>45) levels, indicating inadequate cleaning, were found in order of decreasing rates: Bedside cupboard (44% inadequately cleaned), bedrail (35%), chair (33%), intravenous (IV) pole (28%), alarm bell (26%) and matrass (13%). Significant differences in cleanliness across the departments were detected for three items: IV pole (p=0.002), bedrail (p=0.016) and cupboard (p=0.038). In addition, we detected variability in degree of cleanliness across the quartiles for the bedside chairs (p<0.001), bedrails (p=0.003) and cupboards (p<0.001).

Table 3: Inadequate cleaning as measured by a high ATP test, n (%).

Wing	No of performed tests (n) (%range/ Quartile[1,2,4]	Bed	Bell	IV pole	Chair	Rail	Cupboard
		N=216	N=119	N=130	N=147	N=181	N=164
Medicine	88 (15-20)	10	40	43	39	51	59
Surgery	68 (12-23)	16	25	21	45	28	38
ICU	69 (13-21)	8	12	7	20	23	28
ObGyn	12 (2-4)						
Pediatrics	23 (4-8)	17	20	67	44	53	45
Clinics	48 (12-21)	20	10	38	15	26	27
Total	308 (2-69)	13	26	28	33	35	44
P value[3]		0.626	0.145	0.002	0.166	0.016	0.038

1. Morning shifts 278 (49-81), evening shifts 20 (0-11), night 4 (0-3).
2. Across the four quartiles, there were statistically significant differences in ATP levels (indicating variability in cleanliness) for the bedside chairs (95%CI 26-42%, p<0.001), bedrails (95%CI 28-43%, p=0.003) and cupboards (95%CI 36-52,p<0.001), but not for the other examined items (bed, bell, IV pole).
3. There were statistically significant differences between the departments for three items: IV pole (p=0.002), bed rail (p=0.016) and bedside cupboard (p=0.038), but not for the other evaluated items.
4. Interventions: positive feedback (54, 17%), teaching/guidance (78, 25%), meeting with head nurse (44, 14%), letter (20, 6%).

Peripheral venous catheters are standard components of care in many hospitalized patients. These may cause phlebitis in at least 5% of patients (27,28) and occasionally nosocomial bacteremia as well and accordingly we incorporated this item in our prospective study. Of the assessed 766 peripheral IV catheters, in 202 (30%) the date of insertion was not marked on the bandage (Table 4). Significant differences were detected in the latter rate across the departments (p<0.001). In 45/528 (9%) of evaluated peripheral IV catheters, these were >72 hours in place, the upper allowed limit in our hospital as these lines are not placed by dedicated phlebotomy personnel but interns, with, accordingly, higher rates of complications.

Table 4: Inappropriate management of peripheral intravenous catheter (PIVC), n (%)[1,2].

Wing	No of screened patients (n)(%range/ Quartile)[3,5]	IVC was not securely fastened	Bandage on PIVC not clean	PIVC >72 hours in place	Absence of date on the set	Absence of insertion date on bandage
		N=682%		N=528%	N=613%	N=766%
Medicine	265 (53-68)	5 (2)	11 (4)	33 (14)	80 (31)	90 (34)
Surgery	173 (35-56)	0	8 (5)	8 (5)	7 (4)	27 (16)
ICU	112 (14-43)	1 (1)	1 (1)	4 (5)	4 (4)	29 (27)
ObGyn	48 (12-14)	0	1 (2)	0	3 (11)	3 (6)
Pediatrics	59 (11-24)	3 (5)	1 (2)	0	22 (56)	43 (73)
Clinics	26 (4-12)	2 (8)	0	0	2 (12)	10 (38)
Total	683 (139-227)	11 (2)	22 (3)	45 (9)	118 (19)	202 (30)
P value[4]		0.038	NS	0.006	<0.001	<0.001

1. Morning shifts 666 (98%), evening shifts 17 (2%).
2. Placement: back of hand (249, 37%), forearm (207, 30%), antecubital fossa (197, 29%), leg (27, 4%), head (2,0%). Right side (352, 52%), left side (320, 48%).
3. Statistically significant interquartile differences were noted only for prolonged placement (>72 hours)(p=0.003).
4. There were statistically significant differences between the departments for the designated items.
5. Interventions: positive feedback (123, 18%), guidance (127,19%), meeting with head nurse (47,7%), letter (34,5%), participation in departmental staff meeting (13, 2%).

Table 5 shows the rates of inadequate adherence to guidelines regarding isolation procedures and safe injection practices. Of the 11 items assessing 284 isolated patients, three were found impeccable (>95% perfect) or near impeccable (93%-95% perfect), while 4 items were seemed insufficient several of which had statistically significantly rates across the departments (e.g. inappropriate use of isolation measures, range 3%-19%, p=0.037).

Table 5: Inadequate adherence to guidelines regarding isolation procedures and safe injection procedures, n (%).

	Medicine	Surgery	ICU	Peds	Out-patient	P value
Isolation procedures number[1]	117	66	84	13	4	
Patient-specific BP cuff	18 (16)	4 (6)	-1	0	0	0.002
Inappropriate use of isolation gear	14 (13)	2 (3)	15 (19)	1 (8)	0	0.037
Orange isolation bracelet[2,3] by questioning	22 (19)	0	10 (20)	1 (100)		0.026
Staff accompanying patient to tests is aware of cause for isolation	4 (3)	5 (8)	4 (5)	0		0.526
Safe injections[4] number	91	31	90	15	20	
Drug preparation[5] prior hand disinfection	49 (56)	5 (16)	14 (18)	14 (57)	8 (40)	<0.001
Aseptic prep of surface[6]	52 (62)	10 (32)	20 (25)	7 (47)	13 (68)	<0.001
Disinfection of infusion set prior to drug injection	28 (35)	11 (38)	34 (51)	6 (46)	5 (28)	0.261
Disinfection of ampule prior to injection	35 (44)	11 (38)	37 (50)	3 (20)	6 (32)	0.171
No filled syringes in staff pockets[7]	11 (13)	1 (3)	1 (1)	4 (27)	2 (11)	0.001

1. Hand hygiene compliance (99%), patient-specific isolation equipment (97%), use of gloves (96%), patient-specific nursing cart (95%), gown use (94%), sign indicating appropriate level of isolation (94), appropriate waste bin (93%).
2. Appropriate attire when leaving isolation room for various tests and procedures (100%), appropriate terminal cleaning (100%).
3. Interventions: positive feedback (131, 46%), guidance (71, 25%), meeting with head RN (15, 5%), letter (7, 2%).
4. Staff observed: nurses (203), physicians (32), nursing student (7), phlebotomist (6).
5. Appropriate aseptic preparation of drugs: In a designated room, clean surface, prior hand hygiene: all these items were taken care of according to guidelines >95%.
6. Aseptic technique: residual medication discarded, single use of needles and syringes, solution bottles for single use only, aseptic closure of set infusion bags, drug use<1hours of preparation: all items were taken care of according to guidelines >95%.
7. Discarded needle boxes available and <75% filled at point-of-care, correct discarding of sharps, no recapping, all items were taken care of according to guidelines >95%.
8. BP, blood pressure; ND, not done

We evaluated safe injection procedures in 247 patients. Of the 11 items assessed, seven were found impeccable (>95% perfect), while for the remaining 4 items we found a significant rate of inadequate adherence with guidelines, ranging from 62% (inadequate preparation of the surface used for filling of syringes with injectable medications in medical departments) to 50% of lack of disinfection of medication vials prior to needle insertion in the Intensive Care Unit. For several of these items we found significant differences in rates of inadequate adherence across the departments.

As surgical site infections are considered to be initiated mainly during the operative procedures themselves, we evaluated 112 surgical procedures with a 62 item infection prevention checklist, the majority of which (44) were found to be impeccably adhered to (>99%). The remaining 18 items are shown in **Table 6**. Inadequate adherence ranged from 2% to 77%. Operations are performed in four different sites: Central operating rooms (OR), neurosurgery and cardiac surgery OR, Cesarean sections OR, and ambulatory. As the numbers were small, we did not compare the results for these different sites.

Table 6: Inadequate adherence to guidelines in the operating theaters[1,2], n (%).

Main category	Subheading	n/N (%)[3]
Surgical hand-washing	Inadequate adherence to guideline	25/103 (24)
	Artificial nails or gel manicure	26/105 (25)
Surgical site preparation	Inadequate two minute disinfection with alcohol 70% + 0.5% chlorhexidine	11/99 (11)
	Inadequate adherence with guideline of skin preparation	24/98 (24)
Surgical site during surgery	Change of staff member's positions is not performed back-to-back	2/104 (2)
	Items are not checked for sterility and expiration date	6/105 (6)
Hand hygiene by non-sterile staff when retrieving items from central dispensary	Staff members walk out of OR with gloves	17/107 (16)
	Inadequate hand hygiene	27/107 (25)
	Staff inadequately perform hand hygiene before and after retrieving items	44/82 (54)
Surgical team's attire	Cap does not cover hair completely	21/112 (19)
	Operation attire is also worn outside OR zone	31/77 (40)
	Mask is not changed after each operation or when wet	34/76 (45)
	Bearded staff do not use special masks	33/43 (77)
OR Doors	Are not always shut	14/108 (13)
Urinary catheter	Inadequate hand hygiene prior to insertion	5/46 (14)
	Inadequate attachment of bag, below height of hip	11/46 (24)
	Inadequate attachment of catheter to thigh	10/36 (28)
	Sterile napkin does not cover genitals	23/47 (49)

1. Central Operating Rooms (OR) (49); neurosurgery and cardiac surgery ORs (33); Cesarean section OR (25); Ambulatory OR (6).
2. 62 different items were examined, most of which were adhered to according to guidelines (>95%). This table shows the most prominent items which were not adhered to appropriately.
3. Significant interquartile differences were noted for the following items: Inadequate adherence with guidelines for disinfection of the surgical site (95%CI 6-19%, p=0.001); OR uniforms are worn outside the OR (95%CI 29-52%, p<0.001); a special mask is not used by bearded persons (95%CI 61-88%, p=0.046).

Mechanically ventilated patients were evaluated for adherence to infection prevention and other guidelines: 58 patients in the medical departments, 20 in ICU. Ten items were assessed: Nine items according to documentation, and one according to observation. Of these, eight were according to guidelines (>95%), two were not, as follows. Appropriate care according to guidelines (>95%): Daily documentation in the patient's record regarding mouth care three times/24 hours, medical order for ventilation, ventilation settings, ventilation progress, suction, eye moistening and ventilation tube's depth. Inappropriate care according to guidelines: No alignment between documented and actual ventilation settings, in Medical Departments in 16%, in the ICU in 35%. Lack of daily documentation of balloon pressure was found in the Medical Departments in 33%, and in the ICU in 10%.

DISCUSSION

This study was conducted in a 1000 bed university affiliated general hospital, including all in-patient departments and ambulatory facilities over an entire year. Seven Infectious Control Practitioners (ICPs), all registered nurses, all of whom had completed a one year training program in infection control and passed national certification examination, rounded throughout the departments and ancillary facilities, using the itemized guidelines for eight common infection control practices. The ICPs provided real life guidance to the departments' staff and marked the itemized guidelines, which were subsequently entered into a computer application. Data analysis of the overall 110 items (of the included eight guidelines) revealed that 65 items (59%) were universally adhered to, in particular in the operating theaters (44 of 62 (71%) items were >95% adhered to), regarding safe injection (5 of 16 items), and isolation procedures (4 of 12 items). This allowed for streamlining of subsequent ICP practice, transferring the adhered to items to infrequent surveillance, with increased focusing on the more problematic issues. We will subsequently discuss the major secondary findings of this study.

Ever since a major national outbreak of carbapenem resistant *Klebsiella pneumoniae* was detected in 2005-2006, all Israeli hospitals are required to screen for at risk patients and cohort-

ing positive patients in specific isolation units [16-20,26]. These efforts payed off nationally and locally [27-32]. Although an 85% adherence rate to screening of newly admitted patients with risk factors and an 85% weekly screening of all patients in at risk departments appear impressive, we actually are more concerned about the missed patients. The relevant departments and staff have been informed and we follow along to ascertain increased adherence.

The guideline evaluating Urinary Catheter (UC) management included seven items, two of which were found to be perfectly adhered to. Major components of inappropriate adherence were lack of a daily recording of indication for continued use of the UC (10%), the collection bag lying on the floor (10%) and the catheter not securely attached (17%) to the patient's leg. These items have been well covered in guidelines [33] and by now should have been completely assimilated in daily practice but evidently more observations and on the spot feedback are necessary to increase adherence.

As high quality cleaning is a mainstay of infection control, we included assessment of adequate cleaning, as measured by ATP, in our routine practice [34-36]. The ATP tests from six relevant items from the patients' immediate environment that were frequently tested, revealed a wide range of cleanliness (33%-92%), with significant differences between the department ($p=0.002$) and across the quartiles ($p<0.001$). The data indicate that our hospital faces a serious challenge to achieve and maintain high quality cleanliness [36-39]. The main reasons given for this are the doubling in number of patient beds from 550 to more than 1000 within a decade with associated crowding, and 50-year old infrastructure, which requires substantial investment for upgrading.

Peripheral intravenous catheters (PIVCs) are placed in up to 100% of patients in some departments. Although considered an infrequent source of bacteremia, PIVC associated phlebitis is not uncommon and may affect ± 5% of patients in medical departments [27,28]. Of 666 observed PIVCs, inappropriate management for detected for the five assessed components ranged from 1% (the PIVC was not securely attached in the intensive care unit) to 73% (absence of recorded insertion date in pediatrics). We detected significant differences in appropriateness of care between the departments ($p<0.001$), but not across the quartiles. This allowed for selecting several departments for intensive feedback and instruction.

Isolation of patients carrying multi-drug resistant organisms, such as carbapenem resistant *Enterobacterales*, carbapenem resistant *Acinetobacter baumannii*, methicillin resistant *Staphylococcus aureus*, vancomycin resistant *Enterococcus*, and Clostridium difficile is another mainstay of infection control. Of the 11 items assessing 284 isolated patients, three were found impeccable (>95% perfect) or near impeccable (93%-95% perfect), while four items were seemed insufficient several of which had statistically significantly rates across the departments (e.g. inappropriate use of isolation measures, range 3%-19%, $p=0.037$). In addition, adherence to safe injection guidelines also varied significantly between the departments ($p<0.001$), which allowed for focusing of educational and intervention efforts to certain but not all departments [37-39]

The guideline, which we found could be trimmed most, was the one with which to evaluate behaviour in the operating theaters. 44 of the 62 item infection prevention checklist, were found to be impeccably adhered to (>99%). As surgical site infections are considered to originate mainly during the initial operative procedure, our data indicate that the majority of the items can be safely assessed on an infrequent basis, freeing up time and efforts for focusing on that minority of items, which are not adequately adhered to [40,41].

The last infection control guideline we assessed involved mechanically ventilated patients [42]. Of the ten items were assessed, eight were according to guidelines (>95%), two were not (absence of alignment between documented and actual ventilation settings, in Medical Departments in 16%, in ICU 35%, and lack of daily documentation of balloon pressure, in Medical Departments 33%, in ICU 10%).

Development of evidence based guidelines is a major advancement in clinical medicine in the last two decades. In infection control, this guideline has contributed to major reductions in hospital acquired infections, from central line associated blood stream infections, to urinary catheter associated infections, to surgical site infections and ventilator associated pneumonia. The burden of teaching these guidelines and ascertaining adherence falls mainly on infection control and prevention practitioners (ICP), who in addition need to collect the data regarding adherence and infection rates, show these to the relevant staff, provide continuous feedback and instruction, perform interventions to continuously improve outcome, as demonstrated by additionally collected data. The current study shows the additional burden of the ICP teams, to examine their efforts and assess what works and what does not. Meticulous data collection and analysis allows for separation of which guideline' components are usually not adhered to and focus attention and efforts on these. Those items that are almost always adhered to can be safely side-tracked for infrequent surveillance, thus freeing up time and energy for those other items that are often not adequately adhered to Critical self-evaluation is of crucial importance for ICP teams in order to generate ever increasing added value.

This study has several limitations. First, it is a single hospital experience. However, although all Israeli hospitals use the same guidelines, local differences are expected to be significant, decreasing the usefulness for local self-analysis and direction of efforts of multi-center studies. Second, we did not attempt to determine risk factors for not adhering to certain guideline items, which could have assisted with corrective interventions. This would have required significant in-depth efforts, which were neither part nor purpose of the study. Finally, we analyzed our data after one year of data collection, allowing for assessment of variations across for quartiles possibly we could have reached similar results after only 6 months of data collection, which would have allowed streamlining ICP efforts by transferring perfectly adhered to items for infrequent surveillance.

CONCLUSION

In summary, this one year, hospital wide prospective study of eight components of Infection Control and Prevention, helped

identify a large range of items of guidelines which were consistently found to be adequately adhered to allowing their subsequent deletion from the routine surveillance checklist (and transferal for infrequent surveillance only). The freeing up of time for the ICPs allows for subsequent focusing on problematic items with intensified efforts to improve adherence to the latter and, hopefully, to reduce nosocomial infection rates.

CONFLICT OF INTEREST

The authors declare an absence of financial or other conflict of interest.

FINANCIAL SUPPORT

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AUTHORSHIP

The authors declare that all have contributed substantially to the design of the study, data collection and analysis, and writing of the manuscript in order to warrant authorship. All authors have seen and approve of the submitted version of the manuscript.

ETHICAL CONCERNS

The conduct of the study was approved by the Medical Center's Internal Review Board (Helsinki Committee).

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