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Major article

Costs of postexposure management of occupational sharps injuries in health care workers in the Republic of Korea

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Background: Costs of postexposure treatment of sharps injuries (SIs) in health care workers (HCWs) are an economic burden in many countries. This study analyzed the costs associated with SIs in HCWs in the Republic of Korea.

Methods: Between October 1, 2005, and February 28, 2006, general information on SIs among HCWs and the direct costs (eg, laboratory, pharmacy, medical and surgical treatments) and indirect costs eg, (loss of working days) were collected prospectively from 34 hospitals nationwide.

Results: A total of 700 SIs were documented, 505 of which (72.1%) generated costs. The average costs per SI were pharmacy, 123,091 won (US\$129); laboratory tests, 66,958 won (\$70); medical services, 26,332 won (\$28); and medical treatments, 9,377 won (\$10). The average costs of preventive measures were 160,274 won (\$168) for hepatitis B virus (HBV), 127,858 won (\$134) for hepatitis C virus (HCV), and 139,552 won (\$146) for HIV. Of the laboratory tests, 32.9% were HBV-related, 29.4% were HCV-related, and 19.8% were HIV-related. Of postexposure prophylaxes, 34.9% were HB immunoglobulin and 31.4% were HBV vaccines. We estimated that 7,057.5 SIs generated costs, at a total annual cost of 844,587,577 won (\$884,385).

Conclusions: The direct costs of managing SIs among HCWs constitute an economic burden in Korea. More aggressive and comprehensive preventive measures of SIs should be adopted.

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Sharps injuries (SIs), including needlestick injuries, are the leading cause of occupational exposure of health care workers (HCWs) to blood-borne viruses, including hepatitis B virus (HBV), hepatitis C virus (HCV), and HIV. Along with the risk of transmission of blood-borne diseases and the cost of postexposure management (PEM), some exposed HCWs suffer serious emotional stress, and sometimes even personality changes, after an SI.^{1,2} Thus, many authorities have strongly recommended the institution of occupational SI prevention programs for HCWs, with an

administration-level approach to establishing PEM protocols in health care institutions.³⁻⁵ Such PEM protocols should include the costs of laboratory tests, postexposure prophylaxis (PEP), follow-up medical care, and the loss of working time by exposed HCWs.²⁻⁵ The costs of managing SIs are so great that they constitute an economic burden for health care institutions in many countries.^{2,6-13} The mean costs of SI per exposure have been reported as \$51-\$3,766 in the United States,² €388 in France,⁷ and 39,564 pesetas in Spain.¹⁰ Reported annual costs associated with SIs in studied health care institutions were \$5,354-\$37,271 in one US study,⁶ \$68,994-\$260,554 in another US study,¹³ and €68,310 in France.⁷ The cost is particularly high when the source patient is HIV-positive (\$260-661 per exposure).² Moreover, associated annual medical costs have been estimated as \$107-\$591 million nationwide in the United States.^{5,12}

In Korea, the legal basis of SI prevention in HCWs, defined as the health care employer's responsibility, was first established in 2003, relatively late compared with other countries. To date, there have

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Conflict of interest: None to report.

Table 1
Rates and IDs of SIs generating PEM costs in the study hospitals

	Total	Sharps injuries generating PEM costs	Denominator(person-year, bed-year*) [†]	Rates (1,000 persons, 1,000s bed*) [‡]	Incidence density (1,000 person-year, 1,000 bed-year*) [§]
HCWs	57,578	505	23,990.8	8.8	21.0
Physicians	6,722	110	2,800.8	16.4	39.3
Registered nurses	18,406	246	7,669.2	13.4	32.1
Beds*	27,691*	505*	11,537.9*	18.2*	43.8*

*The figures in each criteria are related to beds, respectively, and the calculation formula is the same as that of the person criteria, respectively.

[†]Total number \times 5/12 year, FTE HCWs.

[‡]Numbers of SIs generating costs/total number \times 1,000.

[§]Number of SIs generating costs/denominator \times 1,000.

been few studies of the costs of SIs or even of their significance to the occupational health of HCWs or the budgets of health care institutions. This study was conducted to analyze and estimate the costs of the PEM of occupational SIs among HCWs in terms of the costs of laboratory tests, medications, medical service appointments, surgical treatments, and work productivity (ie, working days lost by exposed HCWs), and to examine the characteristic costs generated by SIs.

METHODS

Setting

Nationwide, a total of 34 Korean general hospitals with organized blood-exposure prevention programs for HCWs and at least one full-time infection preventionist (IP) were voluntarily enrolled in this study. All IPs in the study hospitals had completed a workshop on the study methods before study initiation, to increase the reliability of data collection.

Study period and subjects

This multicenter study was performed prospectively, with data collected between October 1, 2005, and February 28, 2006. The general characteristics of the study hospitals, including numbers of beds and employees, location, ownership, educational function, type of hospital, and so on, were recorded. The characteristics of the SIs generating costs, in terms of the HCWs exposed (job category, clinical experience, injury, and severity of injury), the identity of the source patient, the workplace in which the injury occurred, and the types of devices involved, were documented.

The direct medical costs of the PEM of each occupational SI exposure were calculated in Korean currency (won). Medical cost categories were laboratory tests, medications (including PEP), medical appointments, surgical treatment of both the exposed HCWs and the source patients, and loss of working days by the exposed HCWs. Data on the cost of the time spent by staff members involved in the PEM process, wages of these staff members and the exposed HCWs, counseling, treatment of infections, and other peripheral costs included in some previous studies^{2,7,8} were not collected in this study. The national magnitude of occupational SIs and the cost of PEM were estimated using national industry employment statistics for HCWs. The medical costs were calculated in Korean won and converted to US dollars using the average 2006 exchange rate of 955:1, to allow international comparisons.

Statistical analysis

The data were analyzed by descriptive statistics (Student *t* test, Mann-Whitney *U* test, and Kruskal-Wallis test) using SPSS version 12.0 for Windows (SPSS, Chicago, IL).

RESULTS

Characteristics

A total of 700 SIs were reported in the 34 study hospitals in a total of 57,578 full-time equivalent (FTE) HCWs and 27,691 beds. Of these 700 SIs, 505 (72.1%) generated PEM costs during the 5-month study period. The overall incidence rate of SIs was calculated as 29.2/1,000 FTE person-years and 60.7/1,000 bed-years. Table 1 presents the incidence rates and incidence densities (IDs) of SIs that generated PEM costs according to occupation.

The 34 study hospitals were distributed around Korea: 13 in Seoul (capital city), 7 in Gyeonggi-do, 6 in Chungcheong-do, 5 in Gyeongsang-do, and 3 in other provinces. The mean (\pm SD) number of beds per hospital was 838 ± 442.3 , and the mean number of FTE HCWs per hospital was $1,790 \pm 1,412$. Twenty-six of the 34 hospitals (76.5%) were university affiliated, 32 (94.1%) were acute care hospitals, and 28 (82.4%) were privately owned. Mean differences in the numbers of SIs generating costs among the different locations ($P = .250$, Kruskal-Wallis test), between university-affiliated and nonaffiliated hospitals ($P = .077$, Mann-Whitney *U* test), and between public or private ownership ($P = .089$, Mann-Whitney *U* test) were not statistically significant.

Needlestick injuries (71.3%; 360 of 505) were the most frequent type of SI generating PEM costs. The other characteristics of those SIs that generated costs are shown in Table 2. Exposed HCWs with less than 20 months of clinical experience included 117 of 246 registered nurses (47.6%) and 73 of 110 physicians (66.4%).

Cost analysis

Descriptive analysis of PEM

All 34 study hospitals paid the medical costs for the PEM of the occupational SIs in their HCWs. Laboratory testing was the most frequently performed element of PEM for exposed HCWs (92.3%; 466 of 505) and source patients (21.2%; 107 of 505). The total number of laboratory tests was 1,584, and the mean number of laboratory tests per HCW was 3.4. Of the 1,584 total laboratory tests, 521 (32.9%) were HBV-related, 466 (29.4%) were HCV-related, 314 (19.8%) were HIV-related, 213 (13.4%) were venereal disease (VD)-related (eg, Venereal Disease Research Laboratory and *Treponema pallidum* hemagglutination tests), and 27 (1.7%) were hepatitis A virus (HAV)-related tests. The actual laboratory tests used were 397 (25.1%) anti-HCV, 303 (19.1%) anti-HIV, 276 (17.4%) HBV surface antigen, and 235 (14.8%) HBV surface antibody.

All drug costs were included in the PEP for HCWs. PEP was instituted after an SI in 28.7% of the HCWs (145 of 505), and that medication was taken a total of 258 times in 145 exposure cases. The most frequently used medications for PEP were hepatitis B immunoglobulin (HBIG) (34.9%; 90 of 258), HBV vaccine (31.4%; 81 of 258), and antiviral drugs for HIV (4.7%; 12 of 258).

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