Mobile phone technology and hospitalized patients: a cross-sectional surveillance study of bacterial colonization, and patient opinions and behaviours

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Abstract

Healthcare workers' mobile phones provide a reservoir of bacteria known to cause nosocomial infections. UK National Health Service restrictions on the utilization of mobile phones within hospitals have been relaxed; however, utilization of these devices by inpatients and the risk of cross-contamination are currently unknown. Here, we examine demographics and characteristics of mobile phone utilization by inpatients and phone surface microbial contamination. One hundred and two out of 145 (70.3%) inpatients who completed a questionnaire detailing their opinions and utilization of mobile phones, also provided their mobile phones for bacteriological analysis and comparative bacteriological swabs from their nasal cavities; 92.4% of patients support utilization of mobile phones by inpatients; indeed, 24.5% of patients stated that mobile phones were vital to their inpatient stay. Patients in younger age categories were more likely to possess a mobile phone both inside and outside hospital ($p < 0.01$) but there was no gender association. Eighty-six out of 102 (84.3%) patients' mobile phone swabs were positive for microbial contamination. Twelve (11.8%) phones grew bacteria known to cause nosocomial infection. Seven (6.9%) phones and 32 (31.4%) nasal swabs demonstrated *Staphylococcus aureus* contamination. MSSA/MRSA contamination of phones was associated with concomitant nasal colonization. Patient utilization of mobile phones in the clinical setting is popular and common; however, we recommend that patients are educated by clear guidelines and advice on inpatient mobile phone etiquette, power charging safety, regular cleaning of phones and hand hygiene, and advised not to share phones or related equipment with other inpatients in order to prevent transmission of bacteria.

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Introduction

A number of studies have consistently reported that 5–21% of healthcare workers' mobile phones provide a reservoir of bacteria known to cause nosocomial infections [1–7]. Despite this knowledge, there exists a paucity of advice provided to either healthcare workers (HCWs) or inpatients on the use or decontamination of mobile phones in hospitals.

Previously, concerns regarding mobile phone electromagnetic interference (EMI) with the function of medical equipment led to UK National Health Service (NHS) restrictions on their utilization in the clinical arena [8]. Further concerns regarding patient confidentiality, data storage, privacy and noise disruption have also been raised (reviewed in Ref. [2]). However, since January 2009, restrictions on the use of mobile phones by medical staff and patients have been removed in the UK [9]. This was principally due to the absence of supportive evidence to demonstrate risks [10,11], advances in handset technology, the reality that many HCWs and patients were using the devices irrespective of restrictions and putative patient psychological advances in avoiding isolation from contacts [12,13].

In view of the withdrawal of previous restrictions, and likely increase in patient utilization of mobile communication technology, the investigators wished to characterize inpatient utilization of mobile phones and assess whether recent changes in policy had implications for infection prevention and control policies aimed at reducing healthcare-associated infections.

In addition, previous studies have reported co-contamination of methicillin-resistant *Staphylococcus aureus* (MRSA) on HCWs' hands and their mobile phones [5,6] and that previously decolonized hands of HCWs can become contaminated by bacteria from the device [4]. Given that mobile phones are in close contact with the user's face during use, we wished to evaluate if patients' mobile phones were associated with personal nasal *Staphylococcus aureus* colonization status.

Materials and Methods

Without prior notification, on five sampling events, consecutive inpatients on surgical/urological wards of the Western General Hospital, Edinburgh, were asked to participate in the study. After agreement, written consent was obtained, and patients provided details of their demographics and opinions and utilization of mobile phones by completion of a questionnaire.

The following exclusion criteria were applied: those who were not mentally capable of consenting, those who had already previously been sampled on a different sampling occasion, and those <16 years of age.

Following completion of the questionnaire, patients were asked to give their mobile phones to the investigators. The investigators used a moist sterile swab (dipped in sterile saline) to sample the phones' keypad areas in a uniform fashion. In addition, a separate sterile swab was also used to sample both anterior nares in a uniform fashion. Swabs were marked with a unique but anonymous identifier code to link questionnaire responses to bacteriological samples. Following sampling, swabs were immediately sealed and transported within 24 h to the Department of Laboratory Medicine at the Royal Infirmary of Edinburgh for further analysis.

Phone swabs were inoculated onto two blood agar plates (Columbia agar containing horse blood; Oxoid, Basingstoke, UK) and incubated, one aerobically and one anaerobically, at 37°C for 48 h. Plates were examined daily and any microorganisms present were identified using standard laboratory procedures. Selected organisms were identified by Vitek 2 using GPI, GNI or ANC cards (Biomerieux, Marcy L'Etoile, France) or the yeast Auxacolor 2 kit (BioRad, Hercules, CA, USA).

Nasal swabs were inoculated onto mannitol salt agar (Oxoid) and incubated at 37°C for 48 h. Plates were examined daily and suspect colonies were subcultured onto blood agar. Isolates were confirmed as *S. aureus* using the Microscreen Staph Latex kit (Microgen, Camberley, UK). Methicillin susceptibility was determined using an oxacillin strip (Mast Diagnostics, Bootle, UK) against a 0.5 MacFarland inoculum on Mueller–Hinton agar (Oxoid). MRSA-positive isolates were stored for further sensitivity testing, phage typing and genotyping at the Scottish MRSA reference laboratory (Glasgow, UK).

Questionnaire responses were transferred to a Microsoft Excel™ worksheet and statistical analysis was performed at the Epidemiology and Statistics Core, Wellcome Trust Clinical Research Facility, University of Edinburgh, Edinburgh.

Differences in proportions were examined using a binomial test for the comparison of proportions while associations in categorical data were examined using chi-square and chi-square test for trend (presented as Fishers exact test as appropriate due to small samples).

Ethical approval and permissions for the above studies were obtained from the Lothian Regional Ethics Committee (10-S1102-36) and Lothian NHS Research and Development Office.

Results

General demographics

One hundred and seventy-five inpatients were approached for inclusion in the study, of whom, 145 (82.9%) agreed to participate (29 refused; one patient was unable to communicate). One hundred and two (70.3%) patients who completed questionnaires also provided a mobile phone for bacteriological sampling and underwent nasal sampling.

Demographics of study population and possession of mobile phone

Twenty-seven (18.6%) patients did not own a mobile phone. Ninety-eight (67.6%) patients owned one mobile phone, 16 (11.0 %) patients owned two mobile phones and four patients (2.8%) owned three or more mobile phones. One hundred and two (86.4%) of those patients who owned a phone brought it into hospital.

Of those responding to the questionnaire, 59% (86/145) were men; 73.3% (63/86) of the male patients and 66.1% (39/59) of the female patients provided mobile phones for analysis (p 0.359, 95% CI for difference in proportions (−8.1%, 27.4%)). There was evidence of an association between age-group and provision of a mobile phone