

## METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS RISK PERCEPTION BY HEALTHCARE PERSONNEL IN A PUBLIC HOSPITAL

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This study examines perceived risk of contamination by methicillin-resistant staphylococcus aureus (MRSA) among healthcare personnel in a French university hospital. MRSA poses a public health threat for healthcare staff who work in a hospital environment. This study is part of a pluridisciplinary research project on the risk factors of MRSA contamination. In many studies (Kouabenan, 1998; Slovic, 1987; Slovic et al., 1981), risk perception appears to be an important factor in understanding attitudes towards accident prevention and self-protective behavior. A questionnaire measuring several dimensions of perceived MRSA risk (risk for oneself, risk for others, severity, controllability, frequency, preventive efforts) and a questionnaire assessing optimism were administered to 187 hospital staff members of various occupations. The results revealed that the risk of MRSA contamination was well perceived as a whole by healthcare personnel. However, certain factors like proximity to patients and length of service tended to be accompanied by an underestimation of the risk, while other factors like little education, working part-time, and a lack of experience tended to cause overestimation. Preventive measures are recommended.

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Controlling the spread of antibiotic-resistant bacteria is a high priority in public health. A microorganism often found in hospitals is methicillin-resistant staphylococcus aureus (MRSA). It has become endemic in a large number of healthcare establishments in France, especially in places that provide care to the elderly (Bradley, 1997). It is as much a threat to patients as it is to staff, and to a lesser extent, their families. Although MRSA colonization during epidemics has been described and the recommended actions are well-known (Goldmann et al., 1996), its prolonged or chronic carriage by hospital personnel has not been studied as much, and procedures regarding what to do in this case have not been clearly defined (Cox & Conquest, 1997; Lessing, Jordens, & Bowler, 1996). In 1998 and 1999, several cases of prolonged carriage were noted in the staff of the University Hospital of Grenoble. These cases generated confusing and poorly controlled situations, including suspension or nonsuspension of work for carriers, guilt feelings on the part of the affected staff members or even within the entire healthcare team, fear of contaminating the family, possible reporting of work-related illness, excessive requests for screening, and local or even, in some cases, systemic antibiotic treatment, despite its negative repercussions in terms of tolerance and cost.

This article presents a study that was part of a pluridisciplinary research project. The project was aimed, firstly, at learning more about the epidemiology of nasal MRSA carriage among hospital personnel, and secondly, at determining MRSA contamination risk factors, especially those related to healthcare workers' perceptions of their own risk of contamination and to their practices on the job (gap between prescribed behavior and actual behavior, skin contact with colonized patients, difficult technical gestures, etc.). The results of the epidemiological study are published elsewhere (see Scarnato et al., 2003). Given the small number of cases of contamination detected during the study ( $N = 14$ ), we confined the present article to risk perception.

### GOALS OF THE STUDY

It is well-known in psychology that beliefs and causal attributions can orient and motivate behavior (Kelley & Michela, 1980; Kouabenan, 1998, 1999; Kouabenan et al., 2001; Slovic, Fischhoff, & Lichtenstein, 1981). Studies on safe behavior are based essentially on the idea that people's attitudes and beliefs are major determinants of their actions (Desrichard & Dubois, 2000; Kouabenan, 2000a, 2000b). In the field of risk perception, there are a number of cognitive and/or motivational distortions known to affect an individual's behavior with respect to hazards and self-protection (for a review, see Kouabenan & Cadet, 2005). It is assumed in numerous self-protective models in health psychology

that the less biased or erroneous a person's perceptions of a risk are, the more likely he/she will be to adopt safe behaviors. Models based on value expectancy are among the most widely studied. In these models, four processes always enter into the adoption of self-protective behavior: (1) awareness of the negative consequences of an event and a desire to reduce them, (2) believing that these negative consequences are likely to happen, (3) believing in the effectiveness of a particular action for lowering the probability of an aversive event's occurrence or for reducing its impact, and (4) evaluating the costs and benefits of the required action (Weinstein, 1993).

Some of these studies have shown that risk perception is based on the characteristics of the risk, including its familiarity and the severity and magnitude of its consequences (whether the effects are potentially catastrophic, immediate or deferred, etc.), but also and especially, it has been pointed out in those studies that certain biases alter the perceptions individuals have of their personal exposure (vulnerability) to the risk, their ability to cope with it, and their control over it (for a review, see Kouabenan & Cadet, 2005 or Slovic, 1994). These biases or illusions generally lead to the underestimation of personal risk (Kouabenan & Cadet, p. 72).

In the light of these findings, the present study looked at how hospital staff members perceive MRSA risk, both for themselves and for others. Our idea was to grasp the extent of awareness among hospital personnel not only of their own risk of exposure to MRSA contamination (personal risk), but also their degree of confidence in their control over personal contamination, their estimates of the frequency and severity of the MRSA risk, and their perceptions of the efforts they make to control risky situations. Each healthcare worker's perceptions of his/her own vulnerability relative to that of coworkers was also measured, since healthcare personnel may very well be more aware of the risk of patient or coworker contamination than they are of their own risk. Similarly, we wanted to find out whether hospital staff members' estimates of the probability of personal risk correspond to their estimates of the probability of MRSA contamination in the entire hospital, or whether, on the contrary, they feel more exposed to this risk than the hospital staff as a whole. It also seemed worthwhile to see how severe the participants in the study consider this health risk to be. Two additional dimensions were measured: perceived possibility of preventing MRSA contamination (controllability) and perceptions regarding personal efforts made to achieve control (if considered possible). Indeed, an event may be perceived as controllable without the subject actually taking any actions to achieve that control. Furthermore, perceived MRSA risk was compared to other perceived risks in a hospital setting. Finally, we wanted to find out whether the general level of optimism, as measured by Scheier and Carver's (1985) scale, would affect perceived MRSA risk among hospital personnel.

## METHOD

### PARTICIPANTS

The observations took place at the University Hospital of Grenoble in three geriatric buildings, since these wards are reputed to be the most exposed to MRSA. A total of 187 persons turned in questionnaires, 185 of which were usable. Among the respondents, 82% were women and 18% were men. Their mean age was 40 and they averaged 141 months of service (almost 12 years). In the breakdown by job category, the occupations best represented were nurses (RN) and head nurses (27.02%), nurses' aides (NA) (29.73%), and ancillary hospital staff members (AHS) (18.37%), but there were also a few physiotherapists/dieticians (5.4%), physicians/interns (5.4%), and volunteer workers (9.18%). The participants were more or less equally divided among the three buildings in the study. It was more difficult to recruit night-shift personnel since the study took place during the day (73.5% of the daytime staff vs. only 9.18% of the nighttime staff).

### MATERIAL AND PROCEDURE

The study was carried out using questionnaires. To begin, the participants had to answer a hazard questionnaire modelled after the one developed by Milhabet, Desrichard, and Verliac (2002). This questionnaire was designed to grasp perceived risk and estimated vulnerability of oneself and others (coworkers), for a series of 13 hazards likely to occur in a hospital setting (pricks or cuts, tuberculosis, hepatitis C or AIDS, splattering of bodily fluids, physical or verbal aggression by patients and/or their family members, skin allergies, slipping or falling, scabies or itching, diarrhea, influenza, osteoarticular injury, wounds from heavy equipment, and MRSA).<sup>1</sup> First the participants had to estimate (on an 11-point scale) the probability that each of the above hazards might affect them personally while at work, rate their severity and frequency at the University Hospital of Grenoble, and assess their controllability and the efforts they made to reduce the occurrence of each risk. Next, the participants were required to fill in the hazard questionnaire again, but this time, by putting themselves in the shoes of their coworkers (ones with the same job as themselves).

The participants were also given Scheier and Carver's (1985) 8-item optimism questionnaire or Life Orientation Test (LOT) and asked to indicate the extent to which they agreed or disagreed with each item on a 5-point scale. Lastly, they had to answer a series of questions about themselves and their job.

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<sup>1</sup> The hazards were chosen based on a preliminary survey and discussion among the members of the research group.

All categories of geriatric personnel were tested in groups of 4 to 6 persons, in the presence of the investigator, in a room reserved for this purpose in the hospital. The staff had been informed about the study in an in-house memo and all participants had volunteered to take part. The average time taken by a participant was 30 minutes.

## RESULTS

The results were analyzed using STATISTICA software and a repeated-measures ANOVA (matched groups).

### PERCEIVED MRSA RISK FOR THE FIVE DIMENSIONS MEASURED (PERSONAL RISK, FREQUENCY, SEVERITY, CONTROLLABILITY, PREVENTIVE ACTIONS)

MRSA risk was perceived as very high ( $M = 9.33$ ) and very serious ( $M = 9.71$ ) for oneself, to a greater extent than it was assumed to be in the entire hospital (frequency  $M = 7.93$ ). These differences were highly significant ( $p < .001$  at least; e.g., for the comparison between personal risk and MRSA-frequency:  $F(1, 178) = 12.69, p = .0005$ ). On the other hand, the hospital staff members felt that the actions they took to control MRSA ( $M = 8.33$ ) were equivalent to the perceived controllability of the risk ( $M = 8.32$ ) (see Table 1). Indeed, there was a significant positive correlation between estimated MRSA controllability and estimated efforts to control it ( $r = .38, p < .0001$ ). The same was true for the estimated probability of personal risk and the estimated frequency of MRSA: the greater the hospital staff members thought the MRSA risk was for themselves, the more frequent they thought it was in the hospital ( $r = .23, p = .001$ ). However, perceived personal risk was negatively correlated with perceived personal control over MRSA ( $r = -.21, p = .005$ ). In other words, the more the staff members thought the MRSA risk was probable for themselves, the less control they felt they had over it. None of the other associations between the five dimensions were significant.

TABLE 1  
MEAN PERCEIVED MRSA RISK ON FIVE DIMENSIONS

Risk Dimension	<i>M</i>	<i>SD</i>
Personal Risk	9.33	2.92
Control	8.33	2.77
Preventive efforts	8.32	3.05
Severity	9.71	2.64
Frequency	7.93	2.99

### PERCEIVED MRSA RISK ACCORDING TO STAFF CONTACT WITH PATIENTS, FOR EACH OF THE FIVE DIMENSIONS MEASURED

In order to examine the perception of MRSA risk according to the job carried

out, the hospital staff members were grouped together on the basis of the amount of patient contact they had in their daily practices (MRSA is known to be spread mainly by skin contact). The following five groups were defined (in decreasing order of contact): (1) nurses' aides (NA), physiotherapists and podiatrists ( $n = 58$ ); (2) nurses (RN), physicians, interns, and medical school students ( $n = 56$ ); (3) ancillary hospital staff (AHS;  $n = 34$ ); (4) volunteer workers ( $n = 17$ ); and (5) head nurses, dieticians, and ergotherapists ( $n = 11$ ).

The AHS group ( $M = 10.09$ ) and the heads/dieticians/ergotherapists ( $M = 9.83$ ) were the ones who felt they ran the highest risk of exposure to MRSA. However, none of the differences were significant. There was only a slight, marginally significant difference ( $p = .10$ ), though, between Group 1 (NAs/physiotherapists/podiatrists) and Group 3 (AHS).

Concerning the estimates of MRSA frequency in the hospital, no significant group differences were found, even though the AHS group estimated the risk to be greater than the other groups did.

The participants who thought that MRSA was controllable were mostly volunteer workers (a group with little patient contact;  $M = 8.51$ ), NAs/physiotherapists/podiatrists ( $M = 8.43$ ), and RNs/physicians/interns/medical students ( $M = 8.38$ ) (two groups with a great deal of contact). Group 3 (AHS) was significantly more pessimistic than these three groups (post hoc test  $p$ -value about .06 in all three comparisons).

Quite curiously, it was the group considered to have the least contact with patients that said they tried the most to control MRSA, that is, the group of head nurses, dieticians, and ergotherapists ( $M = 10.08$ ). This group was followed by the top two groups on the contact dimension (Group 1:  $M = 9.66$ ; Group 2:  $M = 9.86$ ). Here again, and significantly so, the AHS stood out from the other four groups, probably quite naturally, since they made the least amount of effort to achieve control (no doubt a reflection of a certain degree of pessimism in this group) (post hoc test  $p$ -levels between .001 and .007).

Finally, Group 4 (volunteers,  $M = 8.36$ ) and Group 3 (AHS,  $M = 8.18$ ) were the ones who thought MRSA contamination was the most serious (i.e., the groups with not very much contact with patients). However, only the difference between Group 4 (volunteers) and Group 2 (RNs/physicians/interns/med students) approached significance ( $p = .05$ ).

#### **PERCEPTION OF PERSONAL MRSA RISK VERSUS RISK INCURRED BY OTHERS**

Unexpectedly, the participants tended to consider MRSA contamination to be more probable for themselves than for others ( $M = 9.37$  vs.  $M = 8.95$ ;  $F(1, 179) = 2.92$ ,  $p = .08$ ). They also felt that others had more control over it than they did ( $M = 8.33$  vs.  $M = 8.88$ ;  $F(1, 181) = 4.04$ ,  $p = .04$ ), that their own preventive efforts were approximately the same as those of others, and that the risk was as

serious for themselves as for the rest of the hospital staff. In short, the participants feared MRSA contamination and were aware of its severity, but thought they had less control over this germ than their coworkers did.

### DEGREE OF OPTIMISM AND MRSA PERCEPTION

No correlations were found between the degree of optimism and perceived MRSA risk on any of the dimensions studied.

### MRSA RISK PERCEPTION IN TERMS OF CONTAMINATION HISTORY

An analysis (Mann-Whitney Test) of the ratings made by the 11 persons who had been contaminated before this study pointed out an impact of past contamination on perceived MRSA risk. Higher personal risk levels were sensed in cases of prior contamination ( $z = -2.122$ ,  $p = .03$ ); the same was true for estimated MRSA prevention measures ( $z = -2.539$ ,  $p = .01$ ). Perceptions were not affected on any of the other risk dimensions.

TABLE 2  
CONTAMINATION HISTORY AND PERCEIVED MRSA RISK

Risk Dimension	History of Contamination		No History of Contamination	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Personal Risk	8.54	3.41	6.92	3.22
Preventive Efforts	8.72	2.57	6.32	2.83

### PERCEPTION OF MRSA RISK BY LENGTH OF SERVICE, WORK SCHEDULE, AND WORK SITUATION

Length of service tended to be negatively correlated with perceived personal risk ( $r = -.13$ ,  $p = .08$ ): the longer the person had been working, the lower the estimated personal MRSA risk. On the other hand, the work schedule (variable shifts, day or night shift) had no significant effect on perceived MRSA risk, although hospital staff members who worked part-time felt more exposed (mean personal risk = 10.08) than did full-time employees ( $M = 8.98$ ) ( $t(179) = -2.41$ ;  $p = .01$ ).

### ANALYSIS OF PERCEIVED MRSA RISK COMPARED TO PERCEPTIONS OF OTHER HEALTH RISKS, FOR THE FIVE DIMENSIONS MEASURED

A MANOVA computed on the data yielded main effects on various dimensions:  $F(12, 2016) = 27.19$ ,  $p < .0001$  for risk probability;  $F(12, 2064) = 12.12$ ,  $p < .00001$  for perceived control;  $F(12, 2028) = 30.08$ ,  $p < .0001$  for preventive efforts; and  $F(12, 2076) = 92.50$ ,  $p < .0001$  for estimated severity. Post hoc tests showed that the hospital staff deemed MRSA to be significantly more probable

than any of the other 12 health risks studied (see under "Method"). All of these differences were highly significant ( $p = .01$  at least). Likewise, the MRSA risk was judged more controllable ( $M = 7.29$ ) than any other risk ( $p$  values between .02 and .00001) except pricks and cuts ( $M = 7.63$ ). In addition, the subjects said they made more attempts to control MRSA than they did for any other risk, with a highly significant difference for all risks ( $p < .001$ ) and a marginally significant difference only for pricks and cuts ( $p = .08$ ). Finally, the risks judged to be the most serious (in decreasing order) were hepatitis C and AIDS ( $M = 10.89$ ), tuberculosis ( $M = 9.53$ ), and the risk of pricks/cuts by a soiled instrument ( $M = 9.06$ ), that is, risks judged to be nearly as controllable as MRSA. All in all, while being considered highly probable for oneself, the MRSA risk was deemed less serious and more controllable than most of the other health risks assessed (Table 3).

**TABLE 3**  
**COMPARATIVE MEANS AND STANDARD DEVIATION (IN BRACKETS) FOR 13 LIKELY HAZARDS**  
**IN A HOSPITAL SETTING**

	Perceived probability of occurrence	Perceived Control	Preventive efforts	Perceived Severity
Tuberculosis	4.38 (3.18)	6.60 (3.24)	7.54 (3.25)	<b>9.53</b> (1.88)
MRSA infection	<b>7.04</b> (3.26)	<b>7.29</b> (2.80)	<b>9.33</b> (2.25)	8.58 (2.68)
Influenza	6.12 (3.01)	5.53 (2.92)	6.22 (3.24)	5.87 (2.81)
Scabies or itching	3.63 (3.01)	6.31 (3.17)	6.52 (3.67)	(7.60) (2.99)
Diarrhea	4.49 (3.30)	6.73 (3.10)	7.51 (3.42)	7.56 (3.05)
Pricks or cuts	6.62 (3.54)	<b>7.63</b> (2.95)	<b>8.82</b> (2.79)	<b>9.06</b> (2.22)
Hepatitis C or AIDS	5.18 (3.34)	7.02 (3.14)	8.53 (2.95)	<b>10.89</b> (1.28)
Splattering of bodily fluids	6.20 (3.60)	6.08 (2.97)	7.74 (3.13)	8.07 (2.70)
Osteoarticular injury	6.87 (3.28)	6.60 (2.77)	7.74 (2.74)	8.59 (2.43)
Wounds from heavy equipment	5.80 (3.41)	6.77 (2.80)	7.94 (2.60)	8.21 (2.54)
Slipping or falling	5.65 (3.13)	6.18 (2.88)	7.43 (2.88)	8.56 (2.30)
Physical or verbal aggression	6.39 (3.32)	5.67 (3.06)	6.69 (3.24)	7.26 (2.87)
Skin allergies	5.32 (3.20)	5.76 (3.56)	6.56 (3.51)	5.83 (3.05)

## DISCUSSION AND CONCLUSION

This body of findings revealed that the risk of MRSA contamination was well perceived by the hospital personnel questioned here (it was sometimes even overestimated in comparison to the other 12 hazards likely to occur in a hospital setting). This may result from the very fact that the participants knew about the study, and/or may be the outcome of the frequent warnings about this risk received in geriatric wards, where MRSA is, presumably, quite prevalent. The personal risk was considered greater, but the risk of contracting MRSA was judged to be less serious than that of other health risks like hepatitis C or AIDS, and tuberculosis. The healthcare staff members reported efforts to control MRSA that matched its perceived controllability. However, variations were noted for a number of important parameters. First of all, ancillary hospital staff members, who usually have little direct contact with patients, expressed the most pessimistic view of the situation and estimated the MRSA risk as very frequent in the hospital, very probable for themselves, serious, and hard to control, and as a consequence, made little effort to prevent it. The perceptions of individuals in this group – whose job requires less education and training – may be due to a lack of information about MRSA and ways of protecting oneself against it.

Similarly, we found that close contact with patients tended to cause healthcare workers to underestimate perceived MRSA risk (personal risk, frequency, and severity) at the same time as it led them to regard it as controllable and to take preventive action. This was true for length of service too, an effect that has been found in other studies (see Kouabenan, 2002). Indeed, we can see that the healthcare workers' experience (length of service) and work situation (part- vs. full-time) affected their perceptions: full-time work and length of service tended to lower perceived risk. Perhaps these perceptions are rooted in the fact that close contact with patients and more education give individuals the impression of having better knowledge of how MRSA is spread and how it can be prevented. Another possibility is a familiarity phenomenon caused by repeated exposure; this hypothesis is supported by the higher perceived risk noted among hospital workers who had little service or were working part-time. Inversely, the existence of an earlier contamination seems to increase perceived risk and make the concerned individuals more wary. By contrast, no differences were noted in perceived MRSA controllability for persons with a contamination history. All participants deemed controllable a type of contamination whose causes are, in fact, still poorly understood.

Furthermore, the personnel tested did not feel significantly less exposed than others. This goes against what we know about comparative optimism or unrealistic optimism (tendency for individuals to feel they are less exposed to risks than others) (Guppy, 1993; McKenna, 1993; Perloff & Fetzer, 1986; Svenson, 1981;

Weinstein, 1980), unless we assume that the participants compared themselves to coworkers who were, in fact, less at risk than themselves (Eiser, Pahl, & Prins, 2001; Weinstein, 1980). Do these perceptions reflect the true MRSA situation in the wards studied here, or do they simply mean that we should moderate our conclusions about the comparative optimism bias in risk perception in accordance with the nature and actuality of the risk? Clearly, we are dealing here with a specific risk facing hospital staff on a daily basis. Yet most research on comparative optimism has measured optimism regarding general or specific risks, without situating it in a particular context, as in “being the victim of a crime” (Perloff & Fetzer, 1986), or “being involved in an automobile accident” (Guppy, 1993; McKenna, 1993; Svenson, 1981).

In the same way, the present study did not bring out any correlations between the overall degree of optimism (LOT) and perceptions of the different dimensions of MRSA risk. No doubt, this result is primarily due to the differing levels of generality to which these two perception contexts refer (general optimism in life vs. optimism regarding specific hazards in very specific situations). This (unexpected) result can perhaps be explained by the fact that the questionnaire used measures a person’s general level of optimism, whereas the MRSA risks pertained to highly specific hazards. To draw a parallel, note that studies on the relationship between accident proneness and locus of control (internal vs. external) did not find any links when a general measure of locus of control like Rotter’s (1966) was used, whereas links between accident proneness and locus of control were noted when the scales were specific and took situational constraints and the subjects’ experience into account (Guastello & Guastello, 1986; Jones & Wuekber, 1985; Wuekber, 1986).

The overall results obtained in this research suggest that a certain number of preventive measures should be instigated at both the individual and collective levels. MRSA prevention policies should include reminders about obeying hygiene regulations (particularly hand washing), and continuous updating of rules to adapt them to the current situation. In addition, educational and sensitization programs are needed to train and inform hospital staff members. Such programs should insist on the high probability of contamination, even temporary, for healthcare workers in occupations involving frequent contact with patients, that is, nurses and nurses’ aides. Finally, while it is a good idea to inform and reassure individuals in the unskilled health-related occupations, whose education has not provided them with a rational view of MRSA risks (e.g., AHS members), it is also important that the more highly skilled healthcare workers and ones with the most years of service be kept up to date so that MRSA risks will not be seen as commonplace and inconsequential.

Finally it would be interesting in a future study to relate these results on perceived MRSA risk to the findings obtained in epidemiological and ergonomic

studies of occupational practices. This should allow us to define the links (1) between the colonization status of healthcare workers and their perceptions of MRSA risk, and (2) between perceived MRSA risk and contaminating gestures or other work practices. Can a caregiver's colonization status be accounted for in terms of his/her differing perceptions of the risk of MRSA contamination? Will we find a greater tendency among contaminated than uncontaminated personnel to underestimate this risk or to consider it commonplace? Another aim should be to determine whether the work practices and ways of colonized caregivers are less "healthy" than those of noncolonized ones: Do they fail to follow the rules of proper hygiene? Because of the small number of contaminated participants in the present study, such analyses were not possible. Attempts should be made to replicate this kind of study during an outbreak, and on a larger population.

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