



## Major Article

## Overconfidence in infection control proficiency

Stefan Bushuven MD <sup>a,b,\*</sup>, Jana Juenger PhD, MD <sup>c</sup>, Andreas Moeltner PhD <sup>d</sup>,  
Markus Dettenkofer PhD, MD <sup>b</sup>

<sup>a</sup> Institute for Anaesthesiology, Intensive Care Medicine, Emergency Medicine and Pain Therapy, Hegau-Bodensee-Hospital Singen, Singen, Germany

<sup>b</sup> Institute for Hospital Hygiene and Infection Control, Health Care Association District of Constance, Germany

<sup>c</sup> Institute for Medical and Pharmaceutical Examinations, Mainz, Germany

<sup>d</sup> Centre of Excellence for Assessment in Medicine, Heidelberg, Germany



## Key Words:

Hand hygiene  
Feedback  
Speaking up  
Overconfidence effect  
Clinical tribalism  
Heuristic errors

**Background:** Infection control partially depends on hygiene and communication skills. Unfortunately, motivation for continuous training is lower than desired. Many health care providers (HCPs) do not recognize the need for training but express this need for others. This is attributable to heuristic errors, such as the overconfidence effect. The aim of this study was to quantify the flawed self-assessment in infection-control.

**Methods:** In this cross-sectional multicenter study, 255 HCPs of different specialties participated in the 29-item, 5-point Likert scale questionnaire, assessing perceived proficiency in hand hygiene and communication skills for both themselves and others (colleagues, trainees, and supervisors of their own specialty and HCPs of others).

**Results:** 222 of 255 surveys could be analyzed. Respondents rated themselves to be better trained in hand hygiene ( $P < .001$ ) than trainees, colleagues, and supervisors; the same was seen for feedback skills ( $P < .001$ ). HCPs of other specialties were consistently rated worse in all aspects ( $P < .001$ ).

**Conclusion:** Results show an overplacement effect in infection prevention skills. The belief of being well educated creates a subjective conviction that no further education in hand hygiene is needed. Thus, HCPs may face motivation barriers that require specialized programs to overcome these beliefs.

© 2018 Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.

Precautions in hygienic hand disinfection (HHD) are the keystone of prevention of hospital-acquired infections.<sup>1–3</sup> Despite the high impact on morbidity and mortality,<sup>2,4</sup> as well as economics,<sup>5</sup> the intrinsic motivation of personnel to participate in training programs is low.<sup>6</sup> Further, heuristic factors,<sup>7</sup> insufficient team dynamics,<sup>8</sup> and decreased awareness of risky behavior<sup>9</sup> affect protocol adherence and patient safety.<sup>8</sup> These issues are addressed by infection control specialists and medical educators. However, advisors and instructors cannot be omnipresent, thus implying a critical demand for high-quality education in hygiene, collaboration, communication, and respectful mutual control to establish a constructive culture of risk management.<sup>10</sup>

Health care providers (HCPs) face the dilemma of staying up-to-date in times of growing bureaucratic, strategic, and economic tasks;

\* Address correspondence to Stefan Bushuven, MD, Institute for Anaesthesiology, Intensive Care Medicine, Emergency Medicine and Pain Therapy, Hegau-Bodensee-Hospital Singen, D-78224 Singen, Germany.

E-mail address: [s.bushuven@gmx.de](mailto:s.bushuven@gmx.de) (S. Bushuven).

Conflicts of interest: None to report.

Ethics approval and consent to participate: Ethical Committee Stuttgart determined that no application was needed for this study.

rapid medical development; and staff shortage. Consequently, personnel have to prioritize their own education objectives and handle limited time resources.<sup>11</sup>

Hygiene experts routinely encounter many health care workers who see little need for additional hygiene training for themselves but point out the incapacities of colleagues and their need for improvement. This is known as the *overconfidence effect*. According to the review by Moore and Healy,<sup>12</sup> it is defined in the following 3 ways: overestimation (“overestimation of one’s actual ability, performance, level of control, or chance of success”), overplacement (belief of being better than average), and overprecision (“excessive certainty regarding the accuracy of one’s belief”).

Overconfidence is seen across a broad spectrum of human behavior: it boosts risky behavior while driving a car,<sup>13</sup> lowers estimations of general health risks, leads to poor decisions in economics,<sup>14</sup> and may promote criminal behavior.<sup>15</sup> It is most robust because it is innate to human nature; therefore, overconfidence is difficult to overcome by traditional education programs.<sup>13</sup>

The perception groups of professionals have regarding insufficient performance in others is attributable to another effect—the *clinical tribalism phenomenon*.<sup>16</sup> This sociocultural effect strengthens group

identification, collective self-concepts, and group coherence but is counterproductive in cooperative health care because of group rivalries and impaired communication and collaboration.<sup>16,17</sup>

The aim of this work is to clarify and quantify overconfidence (overplacement) concerning basic hygiene procedures and communication skills in a multiprofessional collective using the subjective assessment of training in infection prevention skills (SATIS) questionnaire developed for this study. We hypothesize that HCPs perceive their groups to be better educated in HHD and feedback provision and reception skills, and believe they are more motivated to give feedback (“speaking-up”) and better adhere to hand disinfection protocols than other HPCs. Further, we hypothesize that there is a clinical tribalism phenomenon (ie, rating one’s own specialty better than others’) for all of these issues.

## METHODS

### Study design

This cross-sectional study was conducted from March-May 2017.

### Setting

The study was conducted at 5 German hospitals (2 primary and 2 secondary hospitals and 1 rehabilitation unit) with a total of 1,400 inpatients and more than 1,700 HCPs. Study access was available to participants over the entire period, followed by data processing and analysis in September. Study protocol was approved December 14, 2016, by Ethical Committee Stuttgart and the human resources departments and work councils of all hospitals.

### Participants

SATIS was available to HCPs and distributed by e-mail, Intranet, and hard copy at different collection points. Instructions were given via a cover letter. Participation was promoted by ward and department managers, link nurses, hygiene experts, and repeated Intranet announcements.

### Variables

As a measurement instrument, the SATIS questionnaire was developed prior to the study. It was tested for feasibility, validity, and reliability in 3 test collectives (paramedics, medical education students, and specialized hygiene nurses).

The survey used a 5-point Likert scale and consisted of 30 items (Table 1) and 5 main subject areas, with statements about foreign (trainees, supervisors, colleagues of the same and other specialties) and personal training quality (HHD, feedback provision and reception), adherence to hygiene protocols, and issues of patient safety (“speaking-up”). Respondents used ratings of “full consent” (4 points), “partial consent” (3 points), “neutral” (2 points), “partial rejection” (1 point), and “full rejection” (0 points). Item 30 (collection points of paper-based SATIS sheets that were filled out) was scaled nominally for subgroup analysis.

### Data sources

The paper-based survey was gathered at different collection points (item 30) and was comprised of 5 subgroups. Because of conventions with the working council, no personal details about the participants (eg, age, sex) were obtained.

**Table 1**  
SATIS questionnaire

Item	Question
	I think . . .
1	I am well trained in hygienic hand disinfection
2	I consequently perform hygienic hand disinfection if indicated
3	I consequently correct others if I perceive a mistake in hand hygiene
4	I am well trained in providing feedback
5	I am well trained in receiving feedback
	I consequently correct the following persons if I perceive a mistake in hygienic hand disinfection:
6	Trainees
7	Colleagues within my specialty
8	My supervisors
9	Colleagues from other specialties
	I think the following persons are well trained in hygienic hand disinfection:
10	Trainees
11	Colleagues within my specialty
12	My supervisors
13	Colleagues from other specialties
	I think the following persons consequently use hygienic hand disinfection if indicated:
14	Trainees
15	Colleagues within my specialty
16	My supervisors
17	Colleagues from other specialties
	The following professional groups would consequently correct me if they perceived a mistake in my hand disinfection:
18	Trainees
19	Colleagues within my specialty
20	My supervisors
21	Colleagues from other specialties
	I think the following persons are well trained in providing feedback:
22	Trainees
23	Colleagues within my specialty
24	My supervisors
25	Colleagues from other specialties
	I think the following persons are well trained in receiving feedback:
26	Trainees
27	Colleagues of my specialty
28	My supervisors
29	Colleagues from other specialties

NOTE. SATIS survey items translated into English. In this study, a German survey was used. Item 30 provided the parameters for the collection points of the form. SATIS, subjective assessment of training in infection prevention skills.

### Management

Data processing, statistics, and graphs were conducted using Excel (Microsoft Corp, Redmond, WA) and XLSTAT (Addinsoft, New York, NY).

### Study size

With an anticipated sheet return of 5%, study size was estimated to be about 70–100 participants.

### Bias

To address bias, the SATIS questionnaire was checked for evaluation (closed questions) and application objectivity (self-administered questionnaire, no observer) in the pilot study and rechecked for content validity (main factor analysis, scree plot, varimax rotation) and internal consistency (Cronbach  $\alpha$ , Guttman  $\lambda$ ). Data transfer from

paper to Excel was cross-checked for transcription errors. Retest for internal consistency reached a Cronbach  $\alpha$  of 0.885 and a Guttman  $\lambda_6$  of 0.940.

### Statistical methods

The Friedman and the Mann-Whitney U tests were used for rating comparisons. For correlation analysis, Kendall  $\tau$  was calculated. Significance level, corrected for multiple tests, was set at 0.05. Effect sizes were calculated using intraindividual Cohen  $d_z$ .<sup>18</sup> Power analysis was conducted using G\*Power (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). For subgroup analysis, a Bonferroni-corrected Kruskal-Wallis test with a significance level of 0.05 was used. Questionnaires with missing data were excluded from the a priori analysis.

### Subgroups

With the lack of specifics concerning participant details, 5 subgroups were defined according to the collection points (item 30) defined under consideration of joint staff pools and similar working environments: (1) medical wards, (2) surgical wards, (3) pediatric wards, (4) multiprofessional sites (operating environment, critical care, and emergency departments), and (5) others (complete anonymous sheet returns to institute secretariat). A “completer versus dropouts” was conducted post hoc to partially compensate for selection bias.

## RESULTS

### Participants and descriptive data

Two hundred fifty-five returns (about 15% of all addressed persons) were analyzed. Thirty-three were excluded because of missing

data, leaving 222 from 4 multiprofessional sites (2 intensive care units, 1 emergency department, and 1 operating room [ $n=90$ ]), 4 medical wards ( $n=22$ ), 5 surgical wards ( $n=27$ ), 2 pediatric wards ( $n=36$ ), and others ( $n=47$ ) for statistical investigation (Fig 1). Causes of nonparticipation of single persons or departments were not obtained. Participation of different professional groups was assumed because of more responses at single collection points than staff allocated to 1 group. Evaluation of duty rotas verified physicians, nurses, and physiotherapists working at the collection points.

### Main results

1. Self-perception of education in hand disinfection was higher than ratings for trainees, colleagues of the same specialty, supervisors, and HCPs of other specialties ( $P < .0001$ ). For an HCP's own occupational group, there was no significant difference between perceived training quality in trainees, colleagues, and supervisors ( $P > .05$ ). In contrast, HCPs of other specialties received the poorest ratings compared with colleagues ( $P < .0001$ ), trainees ( $P = .019$ ), and supervisors ( $P = .003$ ). Participants with a high perception of their own competency also rated trainees ( $\tau = 0.195$ ,  $P = .002$ ), colleagues ( $\tau = 0.282$ ,  $P < .0001$ ), and supervisors ( $\tau = 0.162$ ,  $P = .009$ ) higher. This did not apply to colleagues of other specialties ( $P > .05$ ).
2. An HCP's subjective adherence to World Health Organization HHD indications (item 2, compliance) was rated significantly higher compared with trainees, colleagues, supervisors, and other specialties. Again, trainees, colleagues, and supervisors were assessed as having comparable compliance ( $P > .05$ ), with other health care workers being subjectively inferior to them. For HHD protocol adherence, a positive correlation in ratings could be detected for colleagues ( $\tau = 0.287$ ,  $P < .001$ ), supervisors ( $\tau = 0.180$ ,  $P = .003$ ), and other professionals ( $\tau = 0.163$ ,  $P = .007$ ) but not for trainees.

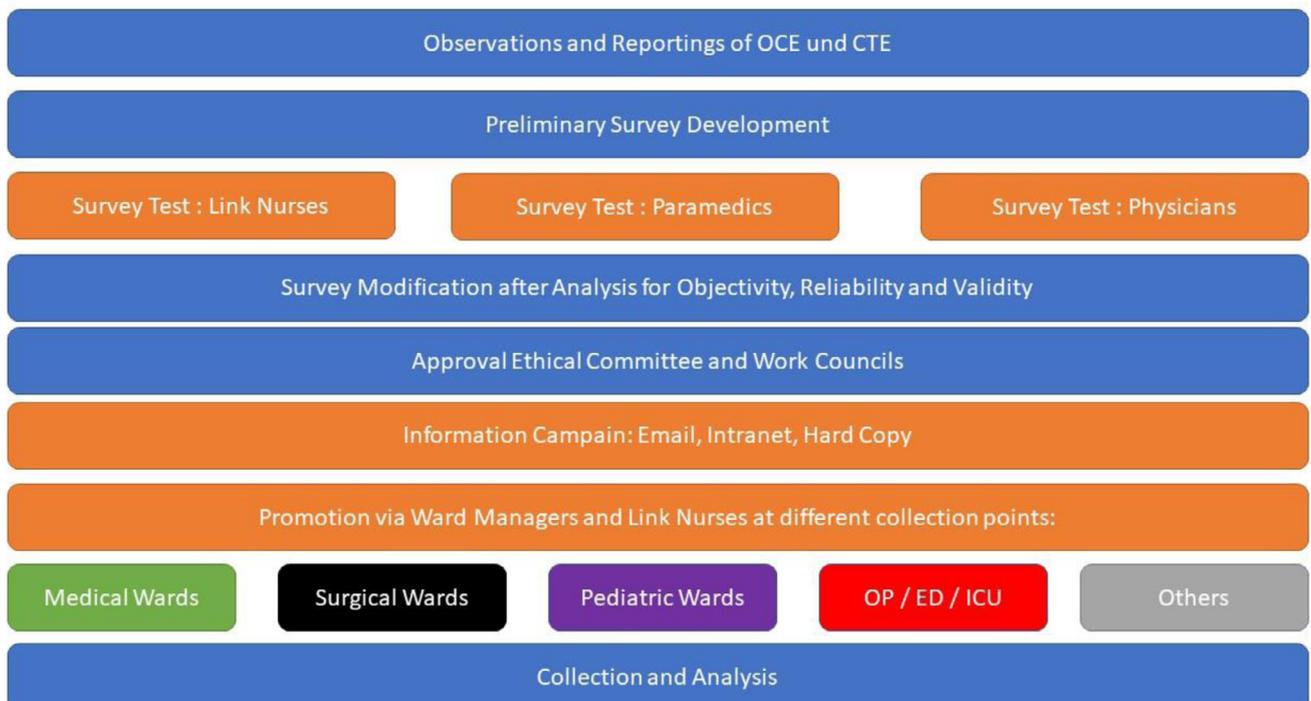


Fig 1. Study concept flowchart.

3. Specific feedback behavior was assessed with items of subtler granularity; overall, the amount of feedback reported was low (mean, 2.045, SD, 0.795). However, the focus on trainees giving feedback to the HCP was significantly higher than the focus on receiving feedback from them ( $P < .0001$ ). For colleagues, there was no difference between providing and receiving feedback. Providing feedback to supervisors was rated as uncommon, but receiving it from them was rated as more likely ( $P < .0001$ ,  $d_z = -0.65$ ). Providing feedback to other professionals and receiving it from them showed no significant difference ( $P = .14$ ,  $d_z = 0.26$ ), with a G\*Power estimated sample size of  $n = 550$  showing significance in favor of an HCP's corrections of other HCPs. Addressing problems with trainees was rated as more likely than being personally corrected by supervisors ( $P < .0001$ ,  $d_z = 0.47$ ). Overall, there was a low "speaking-up" attitude, although an HCP's training in feedback skills (see the following) was rated as significantly higher than the use of feedback ( $P = .001$ ).
4. Perceived competence in providing feedback showed high personal ratings and lower ratings for trainees and other HCPs ( $P < .0001$ ). There was a positive correlation of ratings for personal feedback skills with trainees' ( $\tau = 0.169$ ,  $P = .004$ ), colleagues' ( $\tau = 0.249$ ,  $P < .0001$ ), supervisors' ( $\tau = 0.272$ ,  $P < .0001$ ), and other professionals' ( $\tau = 0.231$ ,  $P < .0001$ ) education in giving feedback.
5. Analysis of feedback reception skills revealed ratings for the perception of an HCP's abilities that were higher in contrast to colleagues ( $P = .006$ ), supervisors ( $P < .0001$ ), and other professionals ( $P < .0001$ ) but equal to those of trainees. All item ratings correlated positively ( $\tau = 0.199-0.323$ ,  $P < .001$ ).
6. Self-estimation ratings above average (3 or 4 points) were shown for HHD (items 1-2), with above average ratings for training in HHD of 91% and adherence to guidelines of 77%. Lower values were seen for "speaking-up" and feedback skills (items 3-5). For these, only 26%, 56%, and 64% assessed themselves as well trained or as speaking up. Self-assessment correlated positively with an HCP's education (item 1-5); those who rated themselves good at hand disinfection rated themselves good at the other skills as well ( $\tau = 0.223-0.341$ ,  $P < .001$ ).

The main results are shown in [Table 2](#).

#### Group differences

For the rating of personal HHD education, there were no differences between subgroups, except for a higher rating in the pediatric group compared with the operating room/emergency department/intensive care unit group ( $P < .001$ ). This effect was also seen in HHD compliance, with additionally higher ratings ( $P < .0001$ ) in the surgical and "other" groups ( $P = .002$ ). Further subdivision into pediatric ( $n = 16$ ) and neonatal care ( $n = 11$ ) subgroups showed no significant difference ( $P > .05$ ) in HHD training and compliance. For overall "speaking-up" compliance, correction of trainees, colleagues, supervisors, and other health care professionals, as well as feedback provision and reception skills, there were no significant group differences. Comparison of responses of "completers" to (otherwise excluded) "dropouts" in rating items 1-5 showed no significant difference, but there was a tendency toward higher self-estimation in the "completer" subgroup ( $P > .05$ ,  $d_{av} = 0.37$ ).

## DISCUSSION

#### Key results

To our knowledge, this is the first study describing the overplacement effect in HHD among health care workers, and it complements

the cluster of heuristic errors seen in infection control (eg, overestimation, Hawthorne effect).<sup>19-21</sup>

Health care workers perceive themselves to be better trained in HHD and feedback competencies compared with trainees, colleagues, and supervisors of the same specialty. Concomitantly, the subjective perception of one's own behavior in speaking up and adhering to HHD indications is higher than the perceived habits of others.

Post hoc analysis showed no group differences, with the exception of pediatric HCPs, who rated themselves even higher. This may be explained by high self-perception,<sup>22</sup> social pressure for obtaining HHD,<sup>23</sup> and other contributing factors, such as role modeling and self-protection.<sup>22</sup>

#### Limitations

Questionnaire return was higher than assumed. Nevertheless, only 15% of the addressed employees responded. Thus, selection bias is 1 of the main limitations of the study.

To compensate for the professionals who were not represented, we used a surrogate approach.<sup>24</sup> We assumed that persons motivated to complete the survey ("completers") had a higher attentiveness to hygiene and were possibly better at it than those who dropped out. We analyzed 33 incomplete questionnaires ("dropouts") with answers to items 1-5. Completers rated themselves slightly higher than dropouts. However, data were underpowered to show significance. Moreover, in addition to hygiene attentiveness, the completer subgroup may have been motivated by demand characteristics, politeness expectations, obedience to authority, and conformity norms.<sup>24</sup> Consequently, motivation to participate and infection control attentiveness should be assessed in future investigations.

Second, details of the participants—especially specialty—were not obtained. Thus, population structure and profession-related and other effects, such as age and sex, are unknown. Demographic data were omitted because of working council regulations; some employees represented their specialty alone at some collection points. With registration of demographic data, anonymity could not be guaranteed. We accepted this limitation because this was a primary investigation focusing on hypothesis generation on this topic.

Third, overestimation and overprecision<sup>12</sup> have not been evaluated. Thus, it remains unclear if those who believe they are above average really are. Future investigations should comprise all 3 subtypes of overconfidence for clarity and interdependency of effects.

Fourth, the response options exhibited a "neutral" option and a risk of tendency toward the central answer. This was especially the case in item 5 (feedback reception), which showed uncertainty regarding actual proficiency in this skill. A 6-point Likert scale should be used in further investigations.

Finally, overconfidence is dependent on culture. People living in Western Europe and North America exhibit higher overplacement than inhabitants of Asia, who exhibit higher overestimation.<sup>25</sup> Therefore, cross-cultural evaluations may show different results.

#### Interpretation

The overconfidence effect, the "mother of all decision errors,"<sup>26</sup> is 1 of the most robust findings in human behavior,<sup>27</sup> with numerous examples in education and health care.<sup>28</sup> Its main causes are information deficits, neglect, errors of omission, incomplete feedback, self-focus, and egocentrism.<sup>28</sup> There is no literature available regarding overplacement or overprecision in hygienic hand disinfection, although there is for overestimation of knowledge,<sup>19</sup> skills,<sup>20</sup> attitude,<sup>2</sup> and behavior.<sup>21</sup> In our investigation, participants showed overplacement in basic proficiencies of infection control and protocol adherence (item 2, compliance). With regard to the learning dimensions,<sup>29</sup> we detected overplacement in behavior (item 2, compliance), although the other 4 (factual knowledge, conceptual knowledge,

**Table 2**  
Overview of rating results

Perception of . . .	Own		Trainees		Colleagues		Supervisors		Other HCPs	
<b>Training quality in hand disinfection</b>										
	Count	%	Count	%	Count	%	Count	%	Count	%
Partially disagree	2	0.9	12	5.4	4	1.8	13	5.7	26	11.7
Neutral	15	6.8	86	38.7	70	31.5	76	34.2	121	54.5
Partially agree	101	45.5	99	44.6	116	52.3	111	50.0	65	29.3
Fully agree	104	46.9	25	11.3	32	14.4	22	9.9	10	4.5
Mean	3.378		2.613		2.793		2.640		2.261	
Standard deviation	0.673		0.769		0.701		0.740		0.733	
Effect size (to own)	N/A		0.83		0.71		0.79		1.13	
P value (to own)	N/A		<.0001*		<.0001*		<.0001*		<.0001*	
<b>Compliance with hand disinfection protocols</b>										
Partially disagree	4	1.8	7	3.2	5	2.3	10	4.5	19	8.6
Neutral	50	22.5	84	37.8	67	30.2	89	40.1	132	59.5
Partially agree	109	49.1	108	48.7	118	53.2	102	46.0	63	28.4
Fully agree	59	26.9	23	10.3	32	14.4	21	9.5	8	3.6
Mean	3.005		2.658		2.793		2.599		2.261	
Standard deviation	0.75		0.718		0.720		0.735		0.689	
Effect size (to own)	N/A		0.35		0.24		0.43		0.80	
P value (to own)	N/A		.085		.990		.018*		<.0001*	
<b>Education in feedback provision</b>										
Partially disagree	32	11.3	71	32.0	30	13.5	33	14.9	47	22.2
Neutral	84	37.8	109	49.1	115	51.8	77	34.7	132	59.5
Partially agree	91	41.0	37	16.7	69	31.1	92	41.4	38	17.1
Fully agree	22	9.9	5	2.3	8	3.6	20	9.0	5	2.3
Mean	2.464		1.842		2.234		2.410		1.991	
Standard deviation	0.893		0.837		0.759		0.929		0.717	
Effect size (to own)	N/A		0.58		0.23		0.05		0.47	
P value (to own)	N/A		<.0001*		.678		1.0		<.0001*	
<b>Education in feedback reception</b>										
Partially disagree	13	5.9	26	11.7	13	5.9	42	18.9	40	38.3
Neutral	64	28.8	95	42.8	124	55.9	93	41.9	132	59.5
Partially agree	109	49.1	78	35.1	76	34.2	77	34.7	46	20.7
Fully agree	36	16.2	23	10.4	9	4.0	10	4.5	4	1.8
Mean	2.748		2.423		2.351		2.216		2.041	
Standard deviation	0.816		0.870		0.693		0.874		0.725	
Effect size (to own)	N/A		0.34		0.48		0.54		0.73	
P value (to own)	N/A		.092		.006*		<.0001*		<.0001*	
<b>Compliance with speaking up in case of error</b>										
<b>Own overall compliance</b>			<b>I correct trainees</b>		<b>Trainees correct me</b>		<b>I correct colleagues</b>		<b>Colleagues correct me</b>	
Partially disagree	46	20.7	6	2.7	116	52.2	44	19.8	44	19.8
Neutral	124	55.9	42	18.9	72	32.4	105	47.3	106	47.8
Partially agree	43	19.4	88	39.6	24	10.8	57	25.7	55	24.8
Fully agree	9	4.0	86	38.7	10	4.5	16	7.2	17	7.7
Mean	2.045		3.131		1.523		2.180		2.171	
Standard deviation	0.795		0.857		1.021		0.882		0.904	
Effect size (to own)	N/A		1.21				0.01			
P value (to own)	N/A		<.0001*				1.0			
			<b>I correct supervisors</b>		<b>Supervisors correct me</b>		<b>I correct others</b>		<b>Others correct me</b>	
Partially disagree			104	46.8	34	15.3	70	31.5	102	45.9
Neutral			73	32.9	68	30.6	93	41.9	90	40.5
Partially agree			38	17.1	86	38.7	47	21.2	20	9.0
Fully agree			7	3.2	34	15.3	12	5.4	10	4.5
Mean			1.635		2.495		1.904		1.599	
Standard deviation			1.012		1.021		1.003		0.966	
Effect size (to own)					- 0.65				0.26	
P value (to own)					<.0001*				.140	

NOTE. Ratings for main results with mean, standard deviation, effect size (dz), and P value. \*significant result ( $p < 0.05$ )  
HCPs, health care providers; N/A, not applicable.

psychomotor skills, and attitude) could not be kept apart because of the generalized formulation of item 1 (ie, “well trained in HHD”). For future investigations, the 3 overconfidence effects should be evaluated for each learning dimension.

With regard to “speaking-up” mentality, our results are consistent with findings by Schwappach et al.<sup>10</sup> Interestingly, respondents rated supervisors equal to themselves in providing feedback and trainees equal in receiving feedback. This conforms with traditional role concepts and stereotypical expectations: supervisors are expected to be good at providing feedback, and trainees are

expected to be good at receiving it.<sup>30</sup> Hypothetically, evaluation of these perceptions in populations with alternative educational approaches, such as peer-assisted learning,<sup>31</sup> may show different results.

Aside from superior self-perception, respondents assessed health care workers of other specialties as worse than members of their own specialty. One explanation for this is a reduced level of information about other groups and their professional lives, with low levels of information creating underestimation and underplacement.<sup>12</sup> Other possibilities are stereotyping, clinical tribalism,<sup>16</sup> and different views, perspectives, and

attitudes.<sup>32–34</sup> As stated above, none of these causes were addressed in this study, and there was no differentiation of other specialties.

Flawed self-perception could play a major role in the motivation to attend infection prevention training (eg, “I am better educated than my colleagues. I do not need training. They do!”). According to Pelaccia and Viau,<sup>35</sup> motivation to attend educational programs depends on 3 factors: value, self-efficacy, and controllability. Thus, overconfident employees may expect to receive no value (according to their judgment) from time-consuming education. This theory should be evaluated further by additionally measuring learning motivation.

For the purpose of altering metacognitive awareness and creating a desire for lifelong learning in infection control, it seems reasonable to confront health care workers about their unwitting overconfidence. Unfortunately, even intensive reflective learning seldom leads to sustainable success.<sup>13,28,36</sup> In contrast, clinical tribalism can be lowered by interprofessional education.<sup>37</sup>

Both “speaking-up” mentality and proficiency in feedback techniques were rated far below desirable values. Although trainees are provided with feedback, supervisors and colleagues are not. This is a common finding—originating from complex factors of workplace culture—in both medical and nonmedical environments.<sup>38,39</sup> As communication and collaboration are essential for risk and infection control,<sup>2</sup> our results support interprofessional training, cultural error, and safety management. Consequently, at participating hospitals, we have introduced additional interprofessional postgraduate training programs, combining infection control and communication proficiencies.

## Conclusions

This multicenter study demonstrates the overplacement effect—a subtype of the overconfidence effect—in HHD and related feedback techniques in 4 clinical environments. Overconfidence is an innate and ubiquitous phenomenon.<sup>27</sup> Thus, it is not surprising to discover its involvement in infection prevention skills. Unfortunately, heuristic errors impair self-assessments of skill in infection control techniques, and this may reduce motivation for ongoing, lifelong training. Educators and hygiene experts have to be aware of these human factors when developing effective training programs for the improvement of infection control and patient safety.

## References

- Pittet D, Allegranzi B, Boyce J. The World Health Organization guidelines on hand hygiene in health care and their consensus recommendations. *Infect Control Hosp Epidemiol* 2009;30:611–22.
- KRINKO. Händehygiene in einrichtungen des gesundheitswesens: empfehlung der Kommission für Krankenhaushygiene und Infektionsprävention (KRINKO) beim Robert Koch-Institut (RKI). *Bundesgesundheitsbl* 2016;59:1189–220. Available from: [https://www.rki.de/DE/Content/Infekt/Krankenhaushygiene/Kommission/Downloads/Haendehyg\\_Rili.pdf?\\_\\_blob=publicationFile](https://www.rki.de/DE/Content/Infekt/Krankenhaushygiene/Kommission/Downloads/Haendehyg_Rili.pdf?__blob=publicationFile). Accessed November 28, 2018.
- Boyce JM, Pittet D. Guideline for hand hygiene in health-care settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HIPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Am J Infect Control* 2002;30 (Suppl):1–46.
- Magill SS, Edwards JR, Bamberg W, Beldavs ZG, Dumyati G, Kainer MA, et al. Multi-state point-prevalence survey of health care-associated infections. *N Engl J Med* 2014;370:1198–208.
- Zimlichman E, Henderson D, Tamir O, Franz C, Song P, Yamin CK, et al. Health care-associated infections: a meta-analysis of costs and financial impact on the US health care system. *JAMA Intern Med* 2013;173:2039–46.
- Steed C, Kelly JW, Blackhurst D, Boeker S, Diller T, Alper P, et al. Hospital hand hygiene opportunities: where and when (HOW2)? The HOW2 Benchmark Study. *Am J Infect Control* 2011;39:19–26.
- Eckmanns T, Bessert J, Behnke M, Gastmeier P, Ruden H. Compliance with antiseptic hand rub use in intensive care units: the Hawthorne effect. *Infect Control Hosp Epidemiol* 2006;27:931–4.
- Hannawa AF. Heuristic thinking: interdisciplinary perspectives on medical error. *J Public Health Res* 2013;2:e22.
- Schwappach DL, Gehring K. Silence that can be dangerous: a vignette study to assess healthcare professionals' likelihood of speaking up about safety concerns. *PLoS One* 2014;9:e104720.
- Schwappach DL. When silence is dangerous: “speaking-up” about safety concerns. *Z Evid Fortbild Qual Gesundheitswes* 2016;114:5–12.
- Galvin SL, Buys E. Resident perceptions of service versus clinical education. *J Grad Med Educ* 2012;4:472–8.
- Moore DA, Healy PJ. The trouble with overconfidence. *Psychol Rev* 2008;115:502–17.
- Sandroni A, Squintani F. A survey on overconfidence, insurance and self-assessment training programs. Available from: [https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKewjFw5bhssjeAhXR0FMKHYisAssQfjAAegQIABAC&url=https%3A%2F%2Fwarwick.ac.uk%2Ffac%2Fsoc%2Fecomics%2Fstaff%2Fsqintani%2Fresearch%2Fsurvey\\_overconfidence.pdf&usq=A0vVaw0sdayNyl4zV7GkCPj9uY](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKewjFw5bhssjeAhXR0FMKHYisAssQfjAAegQIABAC&url=https%3A%2F%2Fwarwick.ac.uk%2Ffac%2Fsoc%2Fecomics%2Fstaff%2Fsqintani%2Fresearch%2Fsurvey_overconfidence.pdf&usq=A0vVaw0sdayNyl4zV7GkCPj9uY). Accessed November 9, 2018.
- Malmendier U, Tate G. CEO overconfidence and corporate investment. *J Finance* 2005;60:2661–700.
- Loughran TA, Paternoster R, Piquero AR, Fagan J. A good man always knows his limitations: the role of overconfidence in criminal offending. *J Res Crime Delinq* 2013;50:327–58.
- Braithwaite J, Clay-Williams R, Vecellio E, Marks D, Hooper T, Westbrook M, et al. The basis of clinical tribalism, hierarchy and stereotyping: a laboratory-controlled teamwork experiment. *BMJ Open* 2016;6:e012467.
- Tajfel H. Social psychology of intergroup relations. *Annu Rev Psychol* 1982;33:1–39.
- Lakens D. Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAs. *Front Psychol* 2013;4:863.
- van De Mortel TF, Kermodé S, Prozano T, Sansoni J. A comparison of the hand hygiene knowledge, beliefs and practices of Italian nursing and medical students. *J Adv Nurs* 2012;68:569–79.
- Škodová M, Gimeno-Benítez A, Martínez-Redondo E, Morán-Cortés JF, Jiménez-Romano R, Gimeno-Ortiz A. Hand hygiene technique quality evaluation in nursing and medicine students of two academic courses. *Rev Lat Am Enfermagem* 2015;23:708–17.
- Neo JR, Sagha-Zadeh R, Vilemeyer O, Franklin E. Evidence-based practices to increase hand hygiene compliance in health care facilities: an integrated review. *Am J Infect Control* 2016;44:691–704.
- Dixit D, Hagtvedt R, Reay T, Ballermann M, Forgie S. Attitudes and beliefs about hand hygiene among paediatric residents: a qualitative study. *BMJ Open* 2012;2:e002188.
- Belela-Anacleto AS, Kusahara DM, Peterlini MA, Pedreira M. Behavioral determinants of hand hygiene compliance in a pediatric intensive care unit from Brazil. *Intensive Care Med* 2015;3(Suppl):721.
- Hoerger M. Participant dropout as a function of survey length in internet-mediated university studies: implications for study design and voluntary participation in psychological research. *Cyberpsychol Behav Soc Netw* 2010;13:697–700.
- Heine SJ, Lehman DR, Markus HR, Kitayama S. Is there a universal need for positive self-regard? *Psychol Rev* 1999;106:766–94.
- Bazerman MH, Moore DA. *Judgment in managerial decision making*. 8th ed. Hoboken (NJ): John Wiley & Sons; 2013.
- Plous S. *The psychology of judgment and decision making*. New York (NY): McGraw-Hill; 1993.
- Dunning D, Heath C, Suls JM. Flawed self-assessment: implications for health, education, and the workplace. *Psychol Sci Public Interest* 2004;5:69–106.
- Thomas PA, Kern DE, Hughes MT, Chen BY, editors. *Curriculum development for medical education: a six-step approach*. Baltimore (MD): Johns Hopkins University Press; 2016.
- Chur-Hansen A, McLean. On being a supervisor: the importance of feedback and how to give it. *Australas Psychiatry* 2006;14:67–71.
- Williams B, Reddy. Does peer-assisted learning improve academic performance? A scoping review. *Nurse Educ Today* 2016;42:23–9.
- O’Leary KJ, Ritter CD, Wheeler H, Szekendi MK, Brinton TS, Williams MV. Teamwork on inpatient medical units: assessing attitudes and barriers. *Qual Saf Health Care* 2010;19:117–21.
- Wauben LS, Dekker-van Doorn CM, van Wijngaarden JD, Goossens RH, Huijsman R, Klein J, et al. Discrepant perceptions of communication, teamwork and situation awareness among surgical team members. *Int J Qual Health Care* 2011;23:159–66.
- Gehring K, Schwappach DL, Battaglia M, Buff R, Huber F, Sauter P, et al. Safety climate and its association with office type and team involvement in primary care. *Int J Qual Health Care* 2013;25:394–402.
- Pelaccia T, Viau R. Motivation in medical education. *Med Teach* 2017;39:136–40.
- Brown JG, Gallagher FM. Coming to terms with failure: private self-enhancement and public self-effacement. *J Exp Soc Psychol* 1992;28:3–22.
- Foster R, Macleod Clark J. Moderating the stereotypical views of health and social care students: the role of interprofessional education. *J Interprof Care* 2015;29:34–40.
- Sur MD, Schindler N, Singh P, Angelos P, Langerman A. Young surgeons on speaking up: when and how surgical trainees voice concerns about supervisors' clinical decisions. *Am J Surg* 2016;211:437–44.
- Tucker S, Turner N. Sometimes it hurts when supervisors don't listen: the antecedents and consequences of safety voice among young workers. *J Occup Health Psychol* 2015;20:72–81.