

1 **Improving Hand Hygiene Adherence in Small-Animal Hospitals: A Social Marketing**

2 **Approach**

3 Bettina Höchli,<sup>\*1</sup> Michael Dorn,<sup>1</sup> Geraldine Holenweger,<sup>1</sup> Claude Messner,<sup>1</sup> Simone

4 Schuller,<sup>2</sup> Helene Rohrbach<sup>2</sup>

5 <sup>1</sup> Institute of Marketing and Management, Department of Consumer Behavior, University of

6 Bern, Bern, Switzerland

7 <sup>2</sup> Vetsuisse Faculty, Department of Clinical Veterinary Science, Small Animal Clinic,

8 University of Bern, Bern, Switzerland

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13 **Author Note**

14 Bettina Höchli  <https://orcid.org/0000-0002-0368-7165>

15 Michael Dorn  <https://orcid.org/0000-0003-1307-3906>

16 Geraldine Holenweger  <https://orcid.org/0000-0001-5752-6036>

17 Claude Messner  <https://orcid.org/0000-0002-7120-0216>

18 Simone Schuller  <https://orcid.org/0000-0002-7316-4423>

19 Helene Rohrbach  <https://orcid.org/0000-0002-5788-1027>

20

21 We have no conflict of interest to declare.

22 Correspondence concerning this article should be addressed to Bettina Höchli, University of

23 Bern, Engehaldenstrasse 4, 3012 Bern, Switzerland. Email: [bettina.hoechli@unibe.ch](mailto:bettina.hoechli@unibe.ch)

24

25 **Abstract**

26 **Background:** Good hand hygiene adherence is a key factor in the prevention of hospital-  
27 acquired infections. The guidelines offered by the World Health Organization for  
28 interventions to improve hand hygiene adherence in human health care can only in part be  
29 applied to veterinary medicine and current observations of hygiene adherence in veterinary  
30 environments stress a need for decisive action. Especially in situations in which people act  
31 habitually, there is great potential for improvement.

32 **Focus of the Article:** The focus of this article is to identify barriers and benefits that  
33 influence hand hygiene habits in veterinary care facilities and to derive intervention strategies  
34 to promote hand hygiene habits informed by theory and formative research.

35 **Research Question:** This article examines two research questions. What contextual, social,  
36 and personal factors promote (benefits) and hinder (barriers) hand hygiene habits in veterinary  
37 care facilities? Which intervention strategies can be derived from the identified barriers and  
38 benefits to foster hand hygiene habits?

39 **Approach:** The identification of the target behavior and group is based on the literature, talks  
40 within the author team, and daily observations. Barriers and benefits are identified by means  
41 of qualitative focus groups. The focus group interview schedule is informed by the RANAS  
42 approach. The intervention strategy is based on the elicited barriers and benefits and guided  
43 by the framework of habit formation.

44 **Importance to the Social Marketing Field:** For the first time, barriers and benefits regarding  
45 hand hygiene habits were systematically elicited in a small-animal clinic in Switzerland. The  
46 article focuses on hand hygiene as a habit and offers evidence-based and behavior-oriented  
47 intervention strategies. Our findings can thus be used as a basis for developing a theoretically  
48 sound intervention to promote hand hygiene habits in veterinary clinics and practices and  
49 serve as a springboard for future social marketing research, especially with a focus on habit  
50 formation.

## IMPROVING HAND HYGIENE ADHERENCE IN SMALL-ANIMAL HOSPITALS

51 **Methods:** Primary data were gathered using eight structured in-depth focus group interviews  
52 (N = 32) in a small-animal clinic in Switzerland. Two focus groups were conducted each of  
53 four professional groups: veterinary assistants; students; residents and interns; and senior  
54 clinicians.

55 **Results:** “Building habits: Promising but challenging to implement“ acts as an overarching  
56 theme across the participant’s talk. Five themes are then discussed that examine in detail the  
57 key barriers and benefits: (1) “Animal welfare as a reason to act”; (2) “It’s not about the why,  
58 but about the how”; (3) “Clash of generations”; (4) “Lack of feedback mechanisms”; and (5)  
59 “Invisible enemy”. Based on these findings and the theoretical framework of habit formation  
60 intervention strategies are derived.

61 **Recommendations for practice and research:** An overview presents the themes that  
62 emerged in the focus groups, connects them to the theoretical framework of habit formation,  
63 and derives possible intervention strategies. Supplementary table, "Intervention Strategies and  
64 Implementation Approaches," delves into the strategies and provides implementation steps for  
65 practitioners facing a similar challenge. Further research is needed to experimentally test the  
66 effect of the intervention strategies, as well as to validate the results for other clinics.

67

68 *Keywords:* hand hygiene, small-animal hospital, social marketing, focus groups, interventions

69                    **Improving Hand Hygiene Adherence in Small-Animal Hospitals: A Social**  
70    **Marketing Approach**

71                    Dogs and cats are family members in many households and benefit from advanced  
72 veterinary care in case of injury or illness. During their hospitalization, pets may develop  
73 hospital-acquired infections (HAI), which may complicate their treatment. Pets may also  
74 become silently colonized with multi-drug-resistant bacteria, contributing to the spread of  
75 these highly problematic bacteria in the environment (Dazio, Nigg, Schmidt, Brillhante,  
76 Campos-Madueno, et al., 2021; Dazio, Nigg, Schmidt, Brillhante, Mauri, et al., 2021) and  
77 potentially to veterinary staff (Endimiani et al., 2020) and pet owners (Dazio, Nigg, Schmidt,  
78 Brillhante, Campos-Madueno, et al., 2021). As in human medicine, pathogens are most  
79 commonly transferred from pet to pet or from the environment to the pet via the hands of the  
80 carers. Therefore, hand hygiene is considered a key factor in the prevention of HAI as it  
81 efficiently interrupts the chain of transmission (World Health Organization, 2009).

82                    The World Health Organization's (WHO's) *SAVE LIVES: Clean Your Hands*  
83 campaign and its *Five Moments for Hand Hygiene* approach define key moments when  
84 health-care workers in *human* medicine should perform hand hygiene: (1) before touching a  
85 patient, (2) before clean/aseptic procedures, (3) after body fluid exposure/risk, (4) after  
86 touching a patient, and (5) after touching patient surroundings (Sax et al., 2007; World Health  
87 Organization, 2009). Although this approach offers a useful toolkit to monitor and foster hand  
88 hygiene and generally improve infection prevention and control standards, its application  
89 cannot be directly transferred to the working environment of veterinary care facilities due to  
90 the different behaviors of animals and humans, as well as different working steps. Current  
91 observations of hygiene adherence in veterinary environments show that hand hygiene is not  
92 yet a habitual behavior and stress a need for decisive action (Schmidt et al., 2021). To date, it  
93 is unclear what barriers hinder hand hygiene habits and what benefits reinforce them, as well  
94 as what intervention strategies in veterinary care settings promote hand hygiene habits.

95 **Adherence to Hand Hygiene Is Insufficient—In Particular for “Non-Dirty” Procedures**  
96 **and Under Time Pressure**

97 Hand hygiene adherence has been assessed in several veterinary care settings (Stull &  
98 Weese, 2015; Weese, 2011; Willemsen et al., 2019). Results uniformly document a need to  
99 improve adherence. They allow first insights into how adherence differs with respect to  
100 occupational group and work steps and which barriers hinder hand hygiene adherence.

101 Regarding occupational groups, the results were mixed: In some cases, veterinarians  
102 showed higher adherence than technical staff (Anderson et al., 2014; Schmidt, 2020); in  
103 others technical staff showed higher adherence than students (Smith et al., 2013); in still  
104 others no differences were observed (Shea & Shaw, 2012). Contamination of hands was  
105 higher for veterinarians than for technical staff (Espadale et al., 2018). However, regarding  
106 working steps, hand hygiene adherence is shown to be remarkably poor before clean/aseptic  
107 procedures. A Swiss study found that adherence was best after so-called dirty procedures such  
108 as contact with bodily fluids (42%) and after patient contact (37%); it was worst prior to  
109 clean/aseptic procedures (12%) (Schmidt et al., 2020). A Canadian study had similar findings.  
110 Adherence was highest after “dirty” procedures (26%) and after patient contact (26%), and far  
111 less pronounced prior to patient contact (3%) and prior to clean procedures (2%) (Anderson et  
112 al., 2014).

113 Workers know that they should clean their hands more frequently (Nakamura et al., 2012) and  
114 that hand hygiene should be improved in their clinic (Anderson & Weese, 2016). They know  
115 that HAIs are a serious threat to patients (Anderson & Weese, 2016; Dowd et al., 2013;  
116 Kupfer et al., 2019). What is it, therefore, that stands in the way of executing correct hand  
117 hygiene? According to self-reports, the main barriers associated with hand hygiene are  
118 workload, time constraints, and stress (Anderson & Weese, 2016; Kupfer et al., 2019;  
119 Nakamura et al., 2012; Smith et al., 2013). These are closely linked to the number of patients  
120 that staff care for (Nakamura et al., 2012). Also important is not having the opportunity to do

121 it right (Smith et al., 2013) and not having access to the necessary equipment (Kupfer et al.,  
122 2019) or hand-washing agents (Nakamura et al., 2012). Some staff report that hygiene gets  
123 forgotten in hectic situations, whereas others say they avoid hand disinfection because it  
124 requires at least 30 seconds or can irritate the skin (Anderson & Weese, 2016).

125 Thus, the results suggest that the main barriers to good hand hygiene are not perceived  
126 lack of importance. Rather hand hygiene adherence decreases in situations where dirty hands  
127 do not cause disgust, as well as in situations of high stress. This means that hand hygiene is  
128 omitted when there is no reminder and no time for a conscious decision. In situations, when  
129 people are not making deliberate choices but instead acting on an automatic response, they  
130 rely on habits (Wellsjo, 2021).

### 131 **Conceptual Framework: Habit Formation**

132 Habits can be defined as learned psychological dispositions to repeat behaviors that  
133 have previously worked in a certain context (Wood & Neal, 2016). Rewarded behaviors that  
134 are repeated in consistent settings begin to occur more frequently and with less conscious  
135 thought. Control of behavior is steadily transferred to cues in the environment that activate an  
136 automatic response (Wood & Runger, 2016). In short, habits develop gradually through  
137 experience when individuals repeat a rewarded action in a recurring context (Wood &  
138 Runger, 2016). A habit, once formed, tends to control behavior even when conventional  
139 intentions do not work, for example, due to stress (Wood & Runger, 2016). Furthermore,  
140 habit formation aims at long-term behavior change. This is particularly important in the case  
141 of hand hygiene, as interventions with a short-term effect do not provide a solution to the  
142 problem of multi-drug-resistant organisms. Habit-formation interventions help people act in  
143 consistent ways that can be repeated frequently and with little thought. Thereby, three  
144 components of habit formation are central: (1) context cues, (2) behavior repetition, and (3)  
145 rewards (Wood & Neal, 2016) (see Figure 1).

146 (Insert Figure 1 here)

147 **Context Cues**

148           In order to trigger habitual behavior, context cues are needed. These cues can take  
149 different forms: Physical reminders such as stickers, posters, or locations; a sound; a  
150 sensation; a time of day; a preceding action or pre-existing habit; a person. The more  
151 frequently a behavior is performed in the presence of a given cue, the stronger the cue itself  
152 becomes a kind of shorthand for the behavior. Thus, the cue comes to trigger the behavior  
153 (Wood & Neal, 2016).

154 **Behavior Repetition**

155           To form habits, the desired behavior needs to be repeated frequently in a recurring  
156 context. Habit-forming interventions create such opportunities in which the desired behavior  
157 is repeated frequently. Interventions can encourage frequent repetition by visually depicting  
158 the repetition of the behavior or by doing exercises precisely in a recurring context (Wood &  
159 Neal, 2016).

160 **Reward**

161           People tend to repeat behaviors that result in positive consequences or reduce  
162 behaviors with negative consequences. Especially at the beginning of habit formation,  
163 rewards are helpful in motivating people to perform behaviors they might otherwise be  
164 reluctant to do. For this reason, habit interventions create opportunities to reward the desired  
165 behavior. This can be an intrinsic reward, such as a good feeling, or an extrinsic one, such as a  
166 monetary incentive or praise from others (Wood & Neal, 2016). Interestingly, habits are  
167 promoted most strongly by occasional and irregular rewards (cf. slot machines). If one  
168 receives a reward every time, one runs the risk of abandoning the behavior as soon as the  
169 reward is gone (Wood & Neal, 2016).

170 **Objective**

171           First results show that there is a need for improvement in hand hygiene adherence,  
172 particularly in settings where there is little time and resources for deliberate, planned action,

173 but where habitual behaviors take over. In this study, we aim to foster a deeper and more  
174 nuanced understanding of the barriers and benefits that affect hand hygiene habits.  
175 Understanding what underpins non-adherence to hand hygiene is a necessary first step. Thus,  
176 our second aim is to give consideration to how to change it. This study addresses two research  
177 questions:

178 Q<sub>1</sub>: What contextual, social, and personal factors promote (benefits) and hinder (barriers)  
179 hand hygiene habits in veterinary care settings?

180 Q<sub>2</sub>: Which intervention strategies can be derived from the identified barriers and benefits to  
181 foster hand hygiene habits?

## 182 **Methods**

### 183 **Design and Data Collection**

184 To answer the first research question, we applied a qualitative approach using semi  
185 structured focus group interviews. Oriented to the social marketing approach (McKenzie-  
186 Mohr, 2011), we first identified the target group and target behavior. Based on the literature  
187 review, on-site observations and discussions within the author team, the target group was  
188 identified as staff in the ward and in the intensive care unit (ICU). In these areas, hand  
189 hygiene adherence is particularly important—yet also very challenging—due to workload and  
190 a high density of patients. All professional groups working in the ward and the ICU of a  
191 small-animal clinic (veterinary nurses; students; interns and residents; senior clinicians) were  
192 invited to participate. With respect to target behavior, it is known that hygiene adherence is  
193 lowest before and after actions without bodily-fluid contact, and before and after contact with  
194 materials and the environment. These procedures affect multiple working steps of employees’  
195 practice—a few selected actions cannot be singled out. Therefore, in the present study we take  
196 a holistic and integrative perspective on hand hygiene that encompasses all working steps  
197 performed in the ward and ICU.



198 Data were collected in July 2020. Eight focus group interviews were conducted in a  
199 small-animal clinic in Switzerland. Groups were selected by professional group, resulting in  
200 two groups each of veterinary nurses (n = 8), students (n = 8), residents and interns (n = 9),  
201 and senior clinicians (n = 7). The composition of a group was based on availability of workers  
202 on a given day. Seven focus groups were conducted in German and one in English. On  
203 average, interviews were 85 minutes in length.

### 204 **Materials**

205 A schedule for the focus group interviews was developed. Our goal was to capture  
206 potential barriers and benefits to hand hygiene habit formation as comprehensively as  
207 possible. Growing evidence supports the use of theory to identify barriers and benefits to  
208 changing behavior (Courtenay et al., 2019). To meet this, we used the Risks, Attitudes,  
209 Norms, Abilities, and Self-regulation (RANAS) approach to systematic behavior change  
210 (Mosler, 2012). This approach aims to facilitate the diagnosis of relevant barriers and benefits  
211 by understanding the determinants of behavior. In addition, it is useful in developing an  
212 intervention strategy because the relevant barriers and benefits can be mapped onto an  
213 intervention function. We applied the determinants of the RANAS approach to the present  
214 challenges of poor hand hygiene adherence, transformed them into interview questions, and  
215 prioritized them within the author team. The final interview schedule was structured into three  
216 parts to comprehensively highlight the barriers and benefits: physical context, social factors,  
217 and personal factors. *Physical context* factors included available materials and infrastructure;  
218 organizational conditions, such as staff deployment; and working processes. *Social* factors  
219 included the local culture with respect to hygiene; role models; clinical hierarchy; and  
220 guidelines and instructions. *Personal* factors included knowledge and risk perception;  
221 motivation; physical and psychological ability; and self-regulation (cf. Mosler, 2012).

### 222 **Data Analysis**

223 Each interview was transcribed and coded in MAXQDA. Data were analysed  
224 thematically, using the approach developed by Braun and Clarke (2006). First, we coded for  
225 the barriers and benefits corresponding to physical context, social, and personal factors.  
226 Second, we conducted an open coding to not overlook any unforeseen barriers and benefits  
227 that emerged in the dataset. Third, we examined repeated and co-occurrences of codes.  
228 Fourth, we explored the text segments for variation and meaning. Fifth, we looked for parallel  
229 concepts and bridging codes to find themes at a higher level of abstraction. This approach  
230 allowed us to analyze the data content and encompass relevant barriers and benefits based on  
231 the theoretical foundation, as well as identify latent patterns and themes in our analysis  
232 (Braun & Clarke, 2013). Preliminary themes were discussed and refined among the research  
233 team so that the data analysis could be written-up and finalized.

### 234 **Qualitative Findings**

235 We first report one overarching theme across the participant's talk: "Building habits:  
236 Promising but challenging to implement". Five themes are then discussed that examine in  
237 detail the key barriers and benefits in habit formation: (1) "Animal welfare as a reason to act";  
238 (2) "It's not about the why, but about the how"; (3) "Clash of generations"; (4) "Lack of  
239 feedback mechanisms"; and (5) "Invisible enemy".

#### 240 **Building Habits: Promising but Challenging to Implement**

241 Participants from all occupational groups see habit formation as one of the most  
242 promising opportunities for improved hand hygiene adherence, especially in stressful  
243 situations when a conscious plan to disinfect hands no longer works. By the same token, the  
244 lack of habit is considered a barrier to adherence. Although the formation of habits was  
245 mentioned as an aim for all occupational groups, there are many factors that hinder it. Habits  
246 are undermined by job rotations, temporary assignments, and hectic, fragmented workflows.  
247 All these make it impossible to repeatedly perform hand hygiene over long periods of time in

248 the same context. Furthermore, goal conflicts and the lack of a culture of feedback are seen as  
249 important barriers. These are discussed in more details in themes (2) and (4) respectively.

### 250 **Animal Welfare as a Reason to Act**

251 In order to promote habits sustainably, it is important that they are aligned with one's  
252 own attitude (Clear, 2018). People tend to repeat behaviors that result in positive  
253 consequences (Wood & Neal, 2016). By recognizing how performing the habitual behavior  
254 has a purpose and fits one's attitude, it promotes the formation of habits.

255 This fit between hand hygiene habits, the purpose behind it and the attitude of the  
256 participants came out clearly in the discussion. Participants from all professional groups  
257 expressed a positive attitude toward hand hygiene. Its purpose was seen mainly as a  
258 contribution to animal welfare. This is reflected in the perception of risk. The risk of  
259 transferring pathogens between animals, and from humans to animals, is seen as greater than  
260 the risk of transmission from animals to humans. A veterinary nurse said: "I don't have such a  
261 fear that I'll pick up anything from the animals—but I am afraid I might spread it to my pets  
262 at home." (All quotations are translated from the German.)

263 The topic of animal welfare also comes into focus with respect to commitment, i.e., to  
264 whom the participants feel obligated to perform hand hygiene on a regular basis. All  
265 participants expressed a feeling of responsibility toward the patients. A resident said that  
266 when one attends to hand hygiene,

267 for sure you feel more comfortable.

268 With the exception of senior clinicians, a responsibility toward the clinic and other  
269 employees was *not* seen as a motivator.

### 270 **Hand Hygiene Adherence Is Not About the Why, but About the How**

271 While attitudes toward hand hygiene are positive and the reason to act is recognized  
272 by participants, the concrete implementation of hand hygiene adherence is more difficult. To

273 form habits, the desired behavior needs to be repeated frequently in a recurring context  
274 (Wood & Neal, 2016). This has proven to be difficult in the discussion, since on the one hand  
275 the rules and instructions are not always clearly and consistently applicable in the veterinary  
276 care setting and on the other hand conflicting goals or a too high workload disrupt the planned  
277 regular process.

278 ***WHO Manual Only Conditionally Suitable***

279 Currently hand hygiene practices in small-animal medicine are based on the World  
280 Health Organization's *Five Moments for Hand Hygiene* (World Health Organization, 2009),  
281 which define key moments when workers in *human* health care should perform hygiene.  
282 However, many participants questioned the suitability of these guidelines for animal care. The  
283 differences are obvious: animals have fur, are in cages rather than beds, and do not  
284 communicate with the staff in the same way that humans do, to name a few. A senior clinician  
285 stated: "I really don't find it [the WHO manual] realistic. It is just not feasible for me  
286 sometimes." Another senior clinician even suggested a need for guidelines specifically  
287 adapted for the veterinary field:

288 Maybe we should use the guidelines of the psychiatric hospital, because at the  
289 end of the day we are dealing with patients who are like children very often or  
290 you have to hold them like psychiatric human patients. Or use guidelines for  
291 pediatricians.

292 ***Conflicting Goals Hinder Hand Hygiene***

293 Other stressors complicate adherence. The participants commented on conflicting  
294 goals, such as workload, overtime, and fatigue. These are seen as barriers to hygiene because  
295 in stressful situations, hygiene becomes less important. A veterinary nurse put it this way: "I  
296 think at some point you have to be finished, and that's the point where you make the first cut,  
297 so to speak. You simply prioritize."

298 Another conflict of goals concerns the punctuality of certain actions expected by the  
299 clinic, such as dispensing medication or recording vital parameters. Such actions—already  
300 difficult given a high workload—are even more difficult to perform punctually with the added  
301 pressure of hand hygiene. A veterinary nurse said:

302 We know that hand disinfection is the most important thing, but the medication  
303 has to be given. It’s a conflict: What is more important now—do I have to be  
304 quick and do it now or do I have the time to disinfect my hands and then give  
305 the medication? If someone could take this decision away from you, it would  
306 be easier.

307 Such goal conflicts lead to hand hygiene’s being omitted, especially by veterinary  
308 nurses, students, interns, and residents who are usually responsible for these time-  
309 critical actions. However, there are no guidelines or best practices on how to deal with  
310 such goal conflicts. Further, whereas the time that medication is given is always  
311 checked, regular hand hygiene is not subject to any recording or control. A nurse said:  
312 “Hand disinfection is not visible. When I gave the medicine, you can see that  
313 afterwards. Also, you just do it [hygiene] for yourself—no one else sees it.”

314 ***Hand Hygiene Is Improving (Resulting in an Even Bigger Workload)***

315 Hand hygiene adherence is gaining additional importance as participants realize that  
316 the hygiene culture in the veterinary setting is improving, resulting in higher demands. Cases  
317 of highly contagious viruses in the clinic, not to mention the COVID-19 pandemic, are  
318 accelerating this process. Given the perceived workload, some participants report resistance to  
319 any changes and demands regarding hand hygiene adherence. A nurse said:

320 We are at the limit with the staff, so employees no longer have the motivation,  
321 the time, the strength to do something new. Even when this new hygiene  
322 concept came along, we were again understaffed, and then comes, Ah, you

323           have to do something new and different again. And you're like: Could you first  
324           of all give us new employees again or new work colleagues, so that I have time  
325           to do this at all?

### 326   **Clash of Generations**

327   To promote habits, it is important that hand hygiene is repeated regularly in a  
328   recurring context (Wood & Rüniger, 2016). This has proved difficult in discussion,  
329   firstly because there can always be changes to hand hygiene guidelines. This proves to  
330   be a major challenge, especially for some established workers. In addition, interactions  
331   between workers at different levels of the hierarchy can lead to routines being  
332   interrupted because, for example, a student does not want to keep his supervisor  
333   waiting.

### 334   *New Generation*

335           Changes in hand hygiene guidelines are not perceived as equally challenging for all  
336   groups. The younger workers tended to see themselves as a new generation with new hygiene  
337   standards. They experience some established workers as negative role models who resist  
338   change. A nurse said:

339           I also think about the upper division. At the top of control—they've been there  
340           for so long and haven't had to do anything for so long—now all of a sudden  
341           you have to do it. This is quite a change for them, too. Less so for us because  
342           we do it every day. But if it's not right up there, it's not right down here either.

### 343   *(Too Much) Respect for Senior Staff*

344           The clash of generations is also evident in the interactions between different  
345   hierarchical levels, particularly when senior clinicians are involved. In stressful  
346   situations, students who are called to supervisors — “Come, please”; “Could you

347 please...” — find it difficult to take time for hand hygiene. They often report that they  
348 are reluctant to make supervisors wait because of hand hygiene. The supervisors, in  
349 turn, assume that the students themselves recognize whether there is time for hand  
350 hygiene or not and do not make them specifically aware of this.

### 351 **Lack of Feedback Mechanisms**

352 To promote habits, feedback has proven to be helpful. Firstly, feedback from  
353 colleagues can act as a reminder. Secondly, it can act as a positive amplifier, as people  
354 tend to repeat behaviors that result in positive consequences (Wood & Neal, 2016). In  
355 addition to feedback from colleagues, some kind of monitoring would allow feedback  
356 regarding one's hand hygiene behavior. Being able to see where there is potential for  
357 improvement and where behavior change is needed is thus the basis for behavior  
358 change (Larson, 2013). Receiving feedback has proven difficult in the discussion for  
359 two reasons. First, there is no feedback culture. Second, there is no system for  
360 monitoring hand hygiene adherence.

### 361 *Underdeveloped Feedback Culture*

362 Concerns about affronting a supervisor are also reflected in statements about feedback.  
363 Reminding each other about hand hygiene is a perceived “no go,” especially when it pertains  
364 to a supervisor. A student said:

365 I think that somehow there is also a certain respect or fear to say, for example,  
366 to a senior clinician, Yes, but you have not disinfected your hands. [Laughter] I  
367 would like to live, I would still like to have a career!

368 Even though mutual feedback regarding hand hygiene is seen by many as useful, it is  
369 often regarded as socially unacceptable. Giving feedback is perceived as sensitive even  
370 between colleagues on the same hierarchical level. A senior clinician said:

371 For me, when someone says to me, Hey, have you washed your hands?, it's  
372 kind of like a reminder maybe [of your parents'] Did you wash your hands? So  
373 it kind of has a negative connotation.

374 ***Lack of monitoring and control***

375 Another cornerstone to enable feedback is some form of monitoring. However,  
376 participants reported a lack of monitoring of compliance (e.g., in night and weekend shifts). A  
377 senior clinician reported:

378 In the wards, I think it's more difficult to have supervision, real supervision,  
379 where many students have to deal with the animals, especially at night. So we  
380 don't even know if really between animal and animal they disinfect hands  
381 every time and how they disinfect hands. [ ...] Often it's just done this way  
382 [rubbing palms together].

383 **Invisible Enemy**

384 In order to trigger habitual behavior, context cues are needed (Wood & Neal, 2016).  
385 The help of cues or reminders for hand hygiene adherence is not equally relevant in all  
386 situations or for all working steps. As in previous research, participants agreed that after  
387 "dirty" procedures—when hands or materials have been contaminated or when animals are  
388 highly contagious—hand hygiene adherence is very good. After "dirty" procedures, the  
389 visibly contaminated hands act as a reminder and the reward of the action, i.e. clean hands, is  
390 also directly visible. However, "normal" situations that are not "disgusting" or highly  
391 contagious are more problematic. In such cases, it is more difficult for the employees to be  
392 aware of the consequences for the patient and the clinic. The pathogens are an invisible  
393 enemy. Thus, these "normal" situations do not act as a cue or reminder and the reward of the  
394 action, i.e. contributing to animal welfare, is not directly visible. This invisibility means that



395 in “normal” situations, hand hygiene often depends on a subjective sense of cleanliness. A  
396 senior clinician said:

397 I think that “after” [touching an animal] is perhaps more subjective. I have the  
398 feeling that the “before” is more internalized, because you do it to protect the  
399 patient. “After,” you do it more for yourself.

#### 400 **Developing Interventions**

401 To answer the second research question, we derived intervention strategies to foster  
402 hand hygiene habits in the context of a Swiss veterinary clinic. To change behavior  
403 effectively, the barriers and benefits identified must be targeted by intervention programs  
404 (Mosler, 2012).

405 To do this, we first rely on the overarching theme and its conceptual framework: habit  
406 formation. As a basis, we drew on the theory of habit formation and its three key components:  
407 1. cueing, 2. behavior repetition, and 3. monitoring and rewarding (see Figure 1). In  
408 discussion with the author team, we mapped the five themes to the three components of habit  
409 formation. Informed by the RANAS approach, we derived five intervention strategies to  
410 promote hand hygiene habits. Table 1 summarizes in an overview the elicited themes, their  
411 links to the habit framework as well as the links between the key components of the habit  
412 framework and the derived intervention strategies. The five proposed intervention strategies  
413 include:

414 (1) Repositioning of the dispensers: The idea is a revision of the dispenser positioning  
415 to increase the number and salience of reminders for hand hygiene. Dispensers themselves act  
416 as context cues for hand hygiene. Available dispensers lead to frequent repetition of hand  
417 hygiene in recurring contexts, which form or strengthen habits (Wood & Neal, 2016). The  
418 simpler the desired behavior, the more likely it will be performed. Dispenser positioning can  
419 minimize the extra effort of hand hygiene (Fogg, 2019).

420 (2) Feedback from colleagues: The idea is that feedback from colleagues acts against  
421 forgetting hand hygiene and as a positive amplifier. Feedback from colleagues acts as a cue  
422 and thus counteracts the “forgetting” of hand hygiene. A colleague’s behavior or brief  
423 feedback thus takes on a similar function as dispensers. Several different cues reinforce habit  
424 formation, compared to a single cue (Clear, 2018). Furthermore, positive feedback can serve  
425 as a reward, encouraging people to continue with a new behavior (Lally & Gardner, 2013) by  
426 promoting autonomy and competence, thus reinforcing intrinsic interest (Deci et al., 1975).  
427 To increase effectiveness, feedback should be timely, non-punitive, individualized, and  
428 adaptable (Larson, 2013).

429 (3) Bottom-up bundling of individual know-how: The idea is to bundle individual  
430 know-how bottom-up. Many ideas for hand hygiene improvements arise during everyday  
431 working practice. Reflective platforms for continuous improvement through the small,  
432 incremental changes allow the bundling and incorporation of this individual know-how from  
433 all professional groups (Goyal & Law, 2019). Such know-how can inform where and how  
434 cues can be incorporated into everyday work, how behavior repetition can be promoted in  
435 recurring contexts as well as what ways of monitoring and rewards which types are perceived  
436 as helpful and welcome among all professional groups.

437 (4) Making risks more visible: The idea is to make the invisibility of risks more  
438 visible. On the one hand, the visibility of the risk can serve as a cue for hand hygiene due to  
439 the increased visibility. On the other hand, it enables a reward by recognizing the risk one  
440 minimizes with correct hand hygiene. The goal is to change perceptions of one’s own  
441 vulnerability and severity of consequences resulting from inadequate hand hygiene (Becker &  
442 Maiman, 1975). This is fostered, first, by increasing threat appraisal of deficient hand hygiene  
443 in a concrete, tangible, and personally relevant way (e.g., at the level of individual patients)  
444 (see protection motivation theory, Rogers, 1975). Thereby it should be noted that immediate  
445 fear appeals may be counterproductive, as they activate defense motivation (De Hoog et al.,

446 2008). Second, it is fostered by coping appraisal (expectations about self-efficacy regarding  
447 the action outcome) of correct hand hygiene, as a perceived lack of control in relation to a risk  
448 is known to reduce the uptake of protective behaviors (Schwarzer, 1992).

449 (5) Monitoring and rewarding: The idea is to support individual responsibility by  
450 monitoring, giving feedback, and rewarding hand hygiene. As a prerequisite for the  
451 motivation to change one's behavior, one needs to be aware of one's own behavior. Often,  
452 employees rate their hygiene practices as better than is actually the case (Larson, 2013).  
453 Monitoring hand hygiene behavior and communicating feedback on the results can align  
454 one's own perceptions and one's actual behavior and thus allow one to realize potential for  
455 improvement. To do so, feedback should be timely, non-punitive, individualized, and  
456 adaptable (Larson, 2013). Furthermore, monitoring allows hand hygiene adherence to be  
457 rewarded (immediately, but occasionally), which in turn fosters habit building (Wood &  
458 Runger, 2016).

459 Supplementary Table 1 provides examples of how the suggested intervention  
460 strategies can be implemented. As an example, if a staff member in a small-animal hospital  
461 wants to implement the intervention strategy of repositioning dispensers, it is a good idea to  
462 conduct site visits with the various professional groups to identify strategic locations for the  
463 dispensers. This will help to identify for example those locations where the professional  
464 groups often pass by.

465 (Insert Table 1 here)

## 466 **Discussion and Conclusion**

### 467 **Statement of principal findings**

468 We conducted focus groups with all occupational groups in a small-animal clinic to  
469 learn the barriers that hinder and benefits that foster hand hygiene habits. "Building habits:  
470 Promising but challenging to implement" acts as an overarching theme across the  
471 participant's talk. Five themes are then discussed that examine in detail the key barriers and

472 benefits in habit formation: (1) “Animal welfare as a reason to act”; (2) “It’s not about the  
473 why, but about the how”; (3) “Clash of generations”; (4) “Lack of feedback mechanisms” and  
474 (5) “Invisible enemy”. In line with findings from the literature, we found that animal welfare  
475 is important for the majority of employees. The lack of hand hygiene is therefore less about  
476 attitude than about implementation. While a high workload is mentioned as a barrier in the  
477 literature (Anderson & Weese, 2016; Kupfer et al., 2019; Nakamura et al., 2012; Smith et al.,  
478 2013), the present work also highlights the impact of goal conflicts and guidelines not  
479 intended for or adapted to the target group. Implementing hand hygiene is made more difficult  
480 by the clinic’s hierarchy, which resists an open feedback culture that would promote  
481 communication and mutual help. These barriers are especially important in situations where  
482 there is no clear indication of infection or visible contamination. The intervention strategies  
483 informed by these findings are based on the framework of habit formation and aim to promote  
484 hand hygiene as a habit.

### 485 **Habit formation and social marketing**

486 The present article combines the social marketing approach with habit formation. The  
487 social marketing approach profits from and relies on the appropriate application of behavioral  
488 theory (Luca & Suggs, 2013). While theory suggests that making a desired behavior habitual  
489 promotes long-term behavior change (Gardner et al., 2021), habit formation as a theoretical  
490 concept is rarely included. More common are concepts addressing intentional behavior such as  
491 social cognitive theory, theory of reasoned action, theory of planned behavior, the health belief  
492 model or the health action process approach (Luca & Suggs, 2013).

493 However, in addition to the focus on intentional behavior, the consideration of non-  
494 intentional, automatic behavior is crucial for the success of behavior change interventions. This  
495 is firstly the case because automatic, habit-driven behavior makes up a large part of our daily  
496 activities (Verplanken, 2018). This is especially true for hand hygiene, as hand hygiene is  
497 mainly determined by habits (Buyalskaya et al., 2023). Second, the consideration is crucial,

498 since habits also act independently from intentional or goal-directed behavior (Wood et al.,  
499 2022). Particularly in times of stress and low resources when self-control is diminished, people  
500 act habitually regardless of their intention (Gardner et al., 2021). Third, habits are also  
501 important in the aftermath of intentional behavior change in order to be able to maintain the  
502 created change in the long term and to be able to shield against temptations, setbacks and  
503 changing moods and emotions (Verplanken & Orbell, 2022).

504 For behavior change interventions to be effective, it must match the impact and  
505 processing level of the target behavior. Thus, if the target behavior is automatic and habit  
506 driven, the intervention too must take into account the unconscious, automatic level, i.e. by  
507 including a cue (Wood et al., 2022). The integration of the habit framework into the social  
508 marketing approach offers a way to make the intervention match the target behavior even in the  
509 case of automatic behaviors.

### 510 **Limitations and future research**

511 The present work identifies barriers and benefits and offers intervention strategies to  
512 foster hand hygiene habits in a veterinary care setting. A first limitation is that it does not yet  
513 allow us to draw conclusions about the actual impact of the intervention strategies. Further  
514 experimental research is needed to test them.

515 It is also not possible to determine the *actual* impact of the barriers and benefits  
516 mentioned in the focus groups. There may well be social desirability bias: For example,  
517 agreeing that patient protection is important could be influenced by social desirability. This  
518 could explain the results of a recent study in which the importance of patient protection does  
519 not lead to higher hand hygiene adherence (Kupfer et al., 2019).

520 It is possible that when participants reflect on their behavior, they truly believe that  
521 factors such as patient safety are important, but in a busy clinical setting, such concerns move  
522 to the background (Kupfer et al., 2019). Further research is needed to test the identified  
523 barriers and benefits for their actual impact on adherence.

524 Another question is the extent to which our findings are scalable to other small-animal  
525 hospitals. We have deliberately referred to a specific small-animal clinic in Switzerland. The  
526 diverse insights of the staff and information about how the healthcare setting in question  
527 operates informed the development of interventions (Forman et al., 2008). It would be  
528 exciting to repeat the study in other clinics to find out to what extent the present barriers and  
529 benefits—and accordingly the interventions—have validity for other clinics.

530 A final limitation is when the study was carried out. The interviews were conducted in  
531 July 2020—after the outbreak of the COVID-19 pandemic. People outside the clinic are now  
532 much more aware of the importance of hand hygiene. For this reason, it cannot be ruled out  
533 that hand hygiene has also become more salient in the clinic as a result. It remains to be seen  
534 if and to what extent the salience of hygiene decreases in the general population over time and  
535 whether this also influences hand hygiene adherence in the small-animal clinic.

### 536 **Practice implications**

537 For the first time, barriers and benefits regarding hand hygiene habits were  
538 systematically elicited in a small-animal clinic in Switzerland. Based on the framework of  
539 habit formation (Wood & Neal, 2016; Wood & R nger, 2016), the article offers evidence-  
540 based and behavior-oriented intervention strategies. Supplementary table, “Intervention  
541 strategies and implementation approaches,” presents the findings for practitioners interested  
542 in addressing the same problem in their setting. The overview presents the themes that  
543 emerged in the focus groups, connects them to the framework of habit formation, and derives  
544 possible intervention strategies. Our findings can thus be used as a basis for developing a  
545 theoretically sound intervention to promote hand hygiene habits in veterinary clinics and  
546 practices and serve as a springboard for future social marketing research.

### 547 **Ethics Statement**

548 The study was conducted in accordance with the recommendations of the institutional  
549 review board (ethical approval number 062020). We ensured a high level of privacy and

550 protection of participants' personal data by obtaining consent, by allowing only a very few  
551 people to have access to the data during collection, and by pseudonymizing identities  
552 immediately after data collection.

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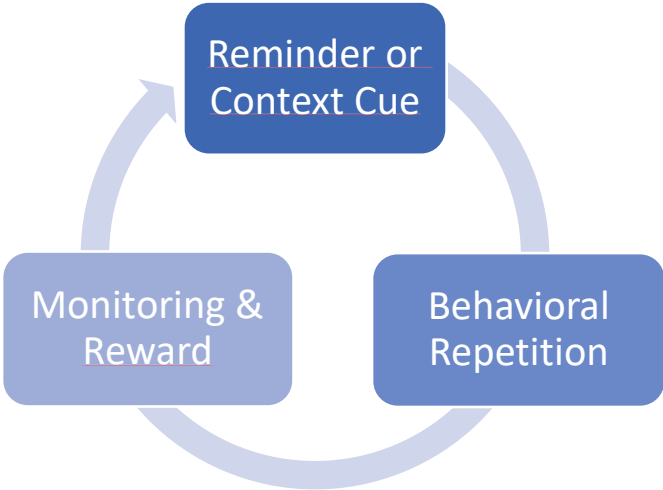
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697  
698  
699

700 Figure 1: Three components of habit formation (adapted from Wood and Neal, 2016, with  
 701 permission).



702

703

704 Table 1: Overview of themes, connection to the three components of habit formation, and  
 705 connection to intervention strategies.

<b>Step 1: Themes that emerged in the focus groups.</b>	
<b>Overarching theme: Building habits: Promising but challenging to implement</b>	
Animal welfare as a reason to act	
It’s not about the why, but about the how	
Clash of generations	
Lack of feedback mechanisms	
Invisible enemy	
<b>Step 2: Linking the themes to the three components of the habit framework.</b>	
<b>Themes</b>	<b>Link to the habit framework</b>
Animal welfare as a reason to act	Reward
It’s not about the why, but about the how	Repetition
Clash of generations	Repetition
Lack of feedback mechanisms	Cue, Reward
Invisible enemy	Cue, Reward
<b>Step 3: Linking the three components of the habit framework to intervention strategies.</b>	
<b>Habit framework</b>	<b>Link to intervention strategies</b>
Cue	Repositioning of the dispensers
	Feedback from colleagues
	Bottom-up bundling of individual knowledge
	Making risks more visible
Repetition	Repositioning of the dispensers
	Bottom-up bundling of individual knowledge
Reward	Feedback from colleagues

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	Bottom-up bundling of individual knowledge
	Making risks more visible
	Monitoring and rewarding

706 Note: For a detailed description of the intervention strategies, see supplementary Table 1.

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### Supplementary Table 1: Intervention strategies and implementation approaches

In the article “Improving Hand Hygiene Adherence in Small Animal Hospitals: A Social Marketing Approach,” focus groups were used to elicit themes that promote or hinder hand hygiene habit formation in a small animal hospital in Switzerland. Subsequently, the themes that emerged were linked to the three components of the theoretical framework of habit formation (cues, repetition, rewards) (Wood & Neal, 2016) and intervention strategies were derived. In this Supplementary Table, we present what the mechanisms behind the proposed intervention strategies are and how they can be implemented. For more information on the focus groups and how the intervention strategies were derived, please refer to the article.

Intervention Strategy	Mechanism	Possible Implementation	Link to the Theoretical Framework of Habit Formation
Revision of the <b>dispenser positioning</b> to increase the number and salience of reminders for hand hygiene	Dispensers themselves act as context cues for hand hygiene. Available dispensers lead to frequent repetition of hand hygiene in recurring contexts, which form or strengthen habits (Wood & Neal, 2016). The simpler the desired behavior, the more likely it will be performed. Dispenser positioning can minimize the extra effort of hand hygiene (Fogg, 2019).	Site visits with the various professional groups to identify strategic locations for dispensers. Such strategic locations may include: <ul style="list-style-type: none"> <li>• Locations where hand hygiene is often poorly performed, e.g., locations where “clean procedures” are performed, where frequent switching from animal to animal (e.g., for medications) or from animal to environment/materials (e.g., during triage) takes place</li> <li>• Locations where the professional groups often pass by</li> <li>• Locations where professionals spend waiting time (e.g., in front of the elevator)</li> </ul> To increase effectiveness, the site visits can be performed in the style of “gemba walks” aimed at reflecting on routine everyday practices (Womack, 2013).	Cue, Repetition
<b>Feedback from colleagues</b> against forgetting hand	Feedback from colleagues acts as a cue and thus counteracts the “forgetting” of hand hygiene. A colleague’s behavior	Clinic-wide feedback campaign aimed at facilitating the giving and receiving of hand hygiene feedback across hierarchical levels. This includes creating a learning environment and trusting environment in	Cue, Reward



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<p>hygiene and as a positive amplifier</p>	<p>or brief feedback thus takes on a similar function as dispensers. Several different cues reinforce habit formation, compared to a single cue (Clear, 2018). Furthermore, positive feedback can serve as a reward, encouraging people to continue with a new behavior (Baldwin et al., 2009; Lally &amp; Gardner, 2013) by promoting autonomy and competence, thus reinforcing intrinsic interest (Deci et al., 1975). To increase effectiveness, feedback should be timely, non-punitive, individualized, and adaptable (Larson, 2013).</p>	<p>which “mistakes” are possible (Baker et al., 2013). Such a feedback campaign may include the following steps (Bas, 2018):</p> <ul style="list-style-type: none"> <li>• Name it: Hand hygiene and feedback on it is communicated as a strategic goal (Baker et al., 2013). This includes a clear communication of expectations about feedback by managers, e.g., by means of team meetings, training, or posters. All employees should know that giving and receiving feedback is a daily goal and not associated with negative consequences (Baker et al., 2013; Marra et al., 2011).</li> <li>• Brand it: The importance and reason why of giving feedback is communicated: All employees work together for the health of animals—by giving feedback, employees help each other do that (Grant &amp; Hofmann, 2011; Larson, 2013).</li> <li>• Show it: Socially influential role models (at all levels of hierarchy) are made aware of their role modeling, and exemplify the behavior (e.g., through behavior in everyday life or testimonials). Thereby, a focus is on leaders for whom giving feedback is more difficult due to their hierarchical position (Marra et al., 2011; Welsh et al., 2012).</li> <li>• Teach it: Exercises (including on-site exercises) on how and when employees give meaningful feedback and how they respond to it are conducted. Employees are actively involved in how, when, and what feedback is given (Larson, 2013). Furthermore, giving feedback is rewarded—both at the moment feedback is received and as part of institutionalized monitoring days.</li> <li>• Institutionalize it: Specific days are specifically designated on which all employees are encouraged to give feedback on hand hygiene, for example, at least five times (e.g., “Feedback sharing Fridays,” Bas, 2018).</li> </ul>	
<p><b>Bundling individual know-how bottom-up</b></p>	<p>Many ideas for hand hygiene improvements arise during everyday working practices. Reflective platforms for continuous improvement through</p>	<p>Approaches to bundle individual know-how may include:</p>	<p>Cue, Repetition, Reward</p>

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	<p>small, incremental changes allow the bundling and incorporation of this individual know-how from all professional groups (Goyal &amp; Law, 2019; R��ther-Wolf et al., 2016).</p>	<ul style="list-style-type: none"> <li>• Kaizen cards (cf. Mazzocato et al., 2016): Cards on which individual ideas or suggestions are collected and published (see Kaizen boards, below).</li> <li>• Kaizen boards (cf. Hasle et al., 2016): Board at strategic point to publicly categorize cards (Ideas, To Do, Doing, Done). These ideas are openly discussed (and adopted, if necessary) on a regular basis, e.g., in the Friday meetings.</li> <li>• Gemba walks (cf. Womack, 2013): Colleagues (from other stations) visit the daily work routine of the station to be optimized. The external perspective helps to identify optimization opportunities that are self-evident and hardly noticeable for internals.</li> <li>• Implementation workshops (cf. Gutzan et al., 2018): Further processing of the improvement needs from the Kaizen boards and Gemba walks by a management team that is as interdisciplinary as possible.</li> </ul>	
<p><b>Making the invisibility of risks more visible</b>—in a concrete, tangible, and personally relevant way</p>	<p>The goal is to change perceptions of one’s own vulnerability and severity of consequences resulting from inadequate hand hygiene (Becker &amp; Maiman, 1975). This is fostered, first, by increasing threat appraisal of deficient hand hygiene in a concrete, tangible, and personally relevant way (e.g., at the level of individual patients or catchment area of clinic) (see protection motivation theory, Rogers, 1975). It should be noted that immediate fear appeals may be counterproductive, as they activate defense motivation (De Hoog et al., 2008). Second, greater awareness of vulnerability is fostered by coping appraisal (expectations about self-efficacy regarding the action outcome) of correct hand hygiene, as a</p>	<p>Hand hygiene case descriptions in regular team meetings to reinterpret hand hygiene from something elaborate to something that (a) saves lives, (b) protects the health of (own) animals, (c) ensures patients access to medical care, (d) constitutes the status of the clinic (Grant &amp; Hofmann, 2011).</p>	<p>Cue, Reward</p>

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	perceived lack of control in relation to a risk is known to reduce the uptake of protective behaviors (Schwarzer, 1992).		
Support individual responsibility by <b>monitoring</b> , giving feedback, and <b>rewarding</b> hand hygiene	As a prerequisite for the motivation to change one's behavior, one needs to be aware of one's own behavior. Often, employees rate their hygiene practices as better than is actually the case (Larson, 2013). Monitoring hand hygiene behavior and communicating feedback on the results can align one's own perceptions and one's actual behavior and thus allow one to realize potential for improvement. To do so, feedback should be timely, non-punitive, individualized, and adaptable (Larson, 2013). Furthermore, monitoring allows hand hygiene adherence to be rewarded (immediately, but occasionally), which in turn fosters habit building (Wood & Runger, 2016).	Irregular monitoring days to measure hand hygiene adherence of different teams, departments, or rooms: <ul style="list-style-type: none"> <li>• Monitoring options: Monitoring can be done using direct observation; indirect observation (e.g., monitoring hand hygiene product consumption); or reciprocal team monitoring (Son et al., 2011; Stewardson et al., 2011; Welsh et al., 2012).</li> <li>• Feedback at departmental- or room-level feedback (vs. individual feedback): Providing individual rates can be counterproductive as it works against the culture where all team members work together for the common goal of improved patient outcomes (Larson, 2013).</li> <li>• Easy and attractive presentation of feedback data: Posting data in prominent places (bulletin boards); communicating to staff and managers during meetings; reporting department-specific data (Welsh et al., 2012).</li> <li>• Involvement of employees: Involving employees in how and when feedback is provided can increase the effectiveness of the feedback. Employees are encouraged to develop and implement suggestions for improvement based on the feedback (Welsh et al., 2012).</li> </ul>	Reward

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