

Development and Psychometric Evaluation of the Speaking Up about Patient Safety Questionnaire (SUPS-Q)

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Abstract

Objective: Speaking up about safety concerns by staff is important to prevent medical errors. Knowledge about healthcare workers' (HCW) speaking up behaviors and perceived speaking up climate is useful for healthcare organizations (HCO) to identify areas for improvement. The aim of this study was to develop a short questionnaire allowing HCOs to assess different aspects of speaking up among healthcare staff.

Methods: HCWs (n=523) from two Swiss hospitals completed a questionnaire covering various aspects of speak up-related behaviors and climate. Psychometric testing included descriptive statistics, correlations, reliabilities (Cronbach's alpha), principal component analysis (PCA), and t-tests for assessing differences in hierarchical groups.

Results: PCA confirmed the structure of 3 speaking up behavior related scales, i.e., frequency of perceived concerns (concern scale, $\alpha = 0.73$), withholding voice (silence scale, $\alpha = 0.76$), and speaking up (speak up scale, $\alpha = 0.85$). Concerning speak up climate, PCA revealed 3 scales (psychological safety, $\alpha = 0.84$; encouraging environment, $\alpha = 0.74$; resignation, $\alpha = 0.73$). The final survey instrument also included items covering speaking up barriers and a vignette to assess simulated behavior. A higher hierarchical level was mostly associated with a more positive speak up-related behavior and climate.

Conclusion: Patient safety concerns, speaking up and withholding voice were frequently reported. With this questionnaire, we present a tool to systematically assess and evaluate important aspects of speaking up in HCOs. This allows for identifying areas for improvement, and as it is a short survey, to monitor changes in speaking up - for example, before and after an improvement project.

Key words: patient safety, speaking up, questionnaire, climate, healthcare

1 **Introduction**

2 Since evidence about hospital-related deaths due to medical errors is rising, a change from the
3 traditional culture of healthcare organizations (HCO)¹ towards more teamwork and a good safety
4 culture occurred.² Open communication about patient safety concerns among healthcare workers
5 (HCW) has raised great attention and is commonly known as “speaking up”.³⁻⁶
6 Speaking up can be defined as assertive communication of patient safety concerns through
7 information, questions, or opinions in clinical situations where immediate action is needed to avoid
8 harm for the patient.^{7,8} Typically, speaking up relates to staff challenging the unsafe behavior of their
9 coworkers or supervisors. Speaking up can be beneficial in a variety of clinical settings, such as in
10 operating rooms, where the probability of error is high and nearly half of the surgical complications
11 are estimated to be preventable,⁹ or in specific situations, such as violation of safety rules (e.g. poor
12 hand hygiene) or false medication. Speaking up has been shown to be positively associated with
13 patient safety in prior studies.^{6,10,11} A variety of factors which lead to individuals’ withholding voice or
14 even collective, organizational silence have been identified.^{12,13} Individual decision-making about
15 whether to speak up or to withhold voice commonly involves complex trade-offs, i.e., evaluations of
16 costs and benefits, such as damaging personal relationships versus preventing patients from harm.^{6,14}
17 Hierarchy has been shown to affect speaking up ; HCWs of lower hierarchy levels are commonly less
18 likely to speak up.^{7,15,16} They may for example doubt of a positive evaluation from their superiors
19 when speaking up.¹⁷ Further, past experiences with colleagues or superiors, such as not feeling
20 supported may lead to withholding voice and resignation, especially in HCWs with lower hierarchical
21 levels.³ The decision whether one speaks up or withholds his voice can be categorized into individual
22 factors (e.g., age, personality), contextual factors (e.g., the presence of patients and co-workers or
23 the risk estimation) and organizational factors (e.g. hierarchy).¹⁵
24 In our previous study conducted in 9 oncology departments, nearly every second HCW was
25 confronted with potentially harmful errors and rule violations at least sometimes, while 70% of the
26 respondents had chosen to remain silent at least once in the past.⁴ With few exceptions, however,
27 little is known about the perceived frequencies of concerns, frequencies of speaking up and of
28 withholding voice in healthcare organizations (HCO) in general.
29 Several questionnaires were developed in the recent years that assess constructs which are known to
30 affect speaking up,¹⁸ such as safety climate questionnaires,¹⁹⁻²¹ the psychological safety at workplace
31 questionnaire,²² the speaking up climate for patient safety and professionalism questionnaire,⁵ and
32 the employee silence scales.²³

33 Despite the growing evidence of speaking up as an important resource for patient safety there is no
34 short instrument that allows HCOs to systematically assess staff behaviors, experiences and
35 perceptions related to speaking up in the organization.

36

37 The aim of the study was to develop a questionnaire allowing HCOs to systematically assess
38 dimensions of both, frequencies of speak up behaviors and speak up related climate. We
39 differentiate between self-reports that are behavior-oriented, i.e., assessing the frequency of specific
40 speaking up behaviors, and self-reports that are climate-oriented, i.e., assessing the subjective
41 perception of work and organizational aspects that are relevant for speaking up. We intended to
42 develop a survey instrument which would be short and easy to self-administer as baseline or follow-
43 up assessment, applicable to both doctors and nurses, and easy to use and interpret by HCOs.

44

45 **Methods**

46 **Study population**

47 The survey was conducted in a pediatric university hospital and a general hospital located in the
48 German-speaking part of Switzerland. Medical doctors and nurses were asked to participate and
49 received a self-administered written questionnaire. Two reminders were sent per email to the entire
50 sample. Finally, 538 individuals completed the questionnaire (i.e. participation rate 37%). Responders
51 with missing data on their function in hospital (professional group and managerial function) were
52 excluded yielding a final sample of 523 completed questionnaires.

53

54 **Item generation and questionnaire structure**

55 After the questionnaire was pre-tested in two hospitals (n=31), which led to the exclusion of three
56 items because of small answer variability of the items, our questionnaire included 11 behavior-
57 related speak up items, one simulated behavior (vignette) with 4 items, and one item assessing 6
58 barriers to speaking up. To assess speak up-related climate 13 items were included.

59 *Speak up-related behavior*

60 Three scales (safety concerns; speaking up; withholding voice) addressed the frequency of specific
61 behaviors over the past 4 weeks. The “concerns” scale covers 3 items which ask how often over the
62 last 4 weeks respondents had experienced different types of patient safety concerns (table 2; PC1-
63 PC3). The “speaking up” scale covers 4 items which ask how often over the last 4 weeks respondents

64 performed specific speaking up behaviors (SU1-SU4), and the “silence” scale mirrors these 4 items
65 and asks how often over the last 4 weeks respondents had chosen NOT to speak up in specified
66 situations, thus to withhold their voice (WV1-WV4). These items were adapted from our previous
67 surveys.⁴ The questions about withholding voice were adapted from the employee silence scale and
68 were used in our prior studies.²³

69 Response options for the 3 scales were “never” (0 times in the last 4 weeks), “rarely” (1-2 times),
70 “sometimes” (3-5 times), “often” (6-10 times), and “very often” (more than 10 times in the last 4
71 weeks).

72 Additionally, item 12 explored the relevance of self-perceived barriers in bringing up patient safety
73 concerns (6 potential barriers; yes/no response scale). Finally, a simulated behavior (vignette) was
74 designed by the research team, together with doctors and nurses. This vignette serves as a
75 standardized stimulus and describes a generic situation requiring speaking up and was followed by 4
76 items (VIG1-VIG4; table 3) assessing respondents’ anticipated behaviors if they would find
77 themselves in a similar situation (7-point-Likert scale).

78 *Speak up-related climate*

79 Six out of the 13 items were adapted from the speak up climate safety scale:⁵ a) “When one
80 expresses patient safety concerns, this results in meaningful changes in my unit”, b) “When I have
81 patient safety concerns it is difficult to bring them up”, c) “The culture in my unit/clinical area makes
82 it easy to speak up about patient safety concerns”, d) “In my unit/clinical area, I observe others
83 speaking up about their patient safety concerns”, e) “I am encouraged by my colleagues (or f) by my
84 shift supervisor) to speak up about patient safety concerns”. Item f) was newly added. Further items
85 were included from a questionnaire assessing psychological safety:²² a) “I can rely on my colleagues,
86 whenever I encounter difficulties in my work”, b) “I can rely on the shift supervisor, whenever I
87 encounter difficulties in my work”, c) “When someone in my unit makes a mistake, it is often held
88 against them”). Furthermore, two items concerning feelings of resignation (“Having to remind of the
89 same safety rules again and again is frustrating” and “Sometimes I become discouraged because
90 nothing changes after expressing my patient safety concerns”) were included, which were already
91 used in our previous survey.⁴ Finally, 2 items relying on past experiences (i.e. “My colleagues (or shift
92 supervisors, respectively) react appropriately, when I speak up about my concerns about patient
93 safety”) were developed. The questions were coded in a 7-point-Likert scale from “strongly disagree
94 with this statement” to “strongly agree with this statement”.

95 **Statistical analysis**

96 Descriptive statistics (means and percentages of items and scales) assessed the distribution of the
97 data. Two exploratory factor analyses (principal component analysis [PCA]) for the items concerning
98 frequencies of behavior (i.e. perceived concerns, withholding voice, speaking up) as well as the items
99 concerning speak up-related climate were performed to identify the underlying scales. Eigenvalues
100 and scree plots were used to determine the number of extracted factors. Orthogonal varimax
101 rotation was used to maximize for independence of the measured dimensions. Reliabilities of the
102 explored scales were measured with Cronbach's alpha. The suitability of the behavioral and the
103 climate items for the PCA was approved by the Kaiser-Meyer-Olkin measure of sampling adequacy
104 ($kmo=0.87$ and 0.86 , respectively) and the Bartlett's test of sphericity ($p<0.001$ for both, behavior
105 and climate items).

106 There was a total of 0.5% missing data across all items. The assumption of Missing Completely at
107 Random (MCAR) was confirmed by dividing respondents into those with and without missing data,
108 then using t-tests for differences in mean of the key variables ($p > 0.05$).²⁴

109 Content validity was explored by testing for differences (t-tests; one-sided $p < 0.05$ was considered
110 statistically significant) between hierarchical groups, and association of hierarchical function with
111 perceived barriers for speaking up were assessed using chi-2 tests. Content validity was also
112 investigated by correlating the behavior-related scales with climate scales. We hypothesized that
113 there is an association between speak up climate and behaviors, such as that a more positive climate
114 would be associated with lower frequencies of withholding voice.

115 Based on results of our last study, we conducted a Power analysis with a two-sided alpha of 0.05 and
116 power of 0.9.⁴ We expected a sample size of $n=489$ in order to detect differences between HCW with
117 and without managerial function for the perceived frequency of patient safety concerns.

118 All analyses were performed with Stata/IC 14.2 (College Station, Texas).

119

120 **Ethical approval**

121 The study was exempted from full ethical review by the Ethics Committee of the Canton of Zurich,
122 Switzerland (BASEC-Nr. Req-2016-00462).

123

124 **Results**

125 The response rate was 37% resulting in a sample of $n=523$. Table 1 summarizes characteristics of the
126 study sample.

127 *Speak up-related behavior assessment*

128 The 15 behavior-related items were fully included in the final survey instrument (see table 2). The
129 conducted PCA resulted in 2 factors with eigenvalue >1, one factor with items of perceived concerns
130 and the second with the speaking up and withholding voice items. As factor loadings of this second
131 component were inversely related for speaking up vs. for withholding voice, a PCA forcing 3 factors
132 was performed. Each of the factors loaded clearly on the concern, silence, and speak up scale. The
133 total variance explained by the 3 factors was 65%, which was superior to the 2 components solution
134 (58%) (data not shown).

135 A majority of the HCWs perceived patient safety concerns, potential harmful errors and rule
136 violations over the last 4 weeks. Between 17% and up to 42% of the HCWs remained silent for at
137 least once e.g., kept information that might have prevented a safety incident. More than half of the
138 HCWs reported to have prevented an incident by speaking up and three quarters would speak up if
139 they considered an error harmful for patients.

140 HCWs without compared to HCW with managerial function as well as nurses compared to doctors
141 had statistically significant higher means in the average scale scores of the concern scale and the
142 silence scale. The average speak up scale score was statistically significantly higher in nurses than in
143 doctors (data not shown).

144 Figure 2 shows the percentages of perceived barriers stratified by profession and managerial
145 function. More than half of HCWs perceived the presence of patients or relatives as a barrier to
146 speak up. Not being able to predict the reaction of the person causing concern and the perceived
147 ineffectiveness of speaking up were also frequently mentioned barriers. All barriers were reported
148 statistically significantly more often by nurses than by doctors, with the exception of the uncertainty
149 how to strike the right note, which was reported statistically significantly more often by doctors.

150 HCWs without managerial function were more likely to report barriers towards speaking up, with
151 statistically significant results for the following 3 barriers: the reaction of the person causing concern
152 is not possible to predict, ineffectiveness (there is no difference whether I state my concerns or not),
153 and fear of a negative reaction (data not shown).

154 Results for the vignette items are shown in table 3. In general, means differed statistically
155 significantly by managerial and professional function, such as that a lower hierarchical status
156 compared to a higher status was associated with identifying the situation as more realistic and more
157 dangerous. Furthermore, staff without managerial function was less likely to speak up in the
158 presented scenario.

159 *Speak up-related climate assessment*

160 After factor analysis, 10 out of 13 items were included in the final survey instrument. Means and
161 factor loadings of the finally included climate items are shown in table 4. A first PCA performed with
162 eigenvalue >1 resulted in two components. As the scree plot indicated a break after the third

163 component (eigenvalue 0.95) and our original items were based on 4 different instruments, we
164 additionally performed a PCA with 3 and 4 forced factors. Finally, comparing the 2-, 3-, and 4-factor
165 solution, we considered the 3-factor solution superior. The 3-factor solution explained 60% of the
166 overall variance from the items concerning speak up climate.

167 According to the results of the PCA, 2 items ("When one expresses patient safety concerns, this
168 results in meaningful changes in my unit" and "When I have patient safety concerns it is difficult to
169 bring them up") did not clearly load on one factor and had low factor loadings and were thus
170 removed. One further item ("When someone in my unit makes a mistake, it is often held against
171 them") was deleted because of the low item total correlation. The 3 final scales were named
172 psychological safety for speaking up scale (PSS), encouraging environment for speaking up scale (EES)
173 and resignation scale (RES).

174 Content validity was first tested by analyzing differences in responses in relation to respondents'
175 hierarchical position. As expected, HCWs without managerial function compared to HCWs with
176 managerial function (and nurses compared to doctors, respectively) had statistically significant lower
177 levels on the PSS and ESS, and higher levels on the RES (see fig. 1). The only exception being that
178 means of the EES did not differ significantly between doctor and nurses. As a second approach to
179 content validity, we inspected correlations between behavior-related and climate scales. PSS was
180 negatively correlated with withholding voice and speaking up (-0.53, -0.23, respectively). EES was
181 only weakly negatively correlated with withholding voice and not correlated with speaking up (-0.36,
182 -0.04, respectively). Resignation was positively correlated with withholding voice and speaking up,
183 correlations being stronger in withholding voice (0.42, 0.32, respectively) (table 5).

184 **Discussion**

185 *Speak up-related behavior assessment*

186 Three scales, one vignette and perceived barriers defined this assessment. Results from the PCA
187 indicated that the scales assessing the frequencies of patient safety concerns, speaking up and
188 withholding voice clearly differed from each other and were reported frequently. These results are in
189 line with a conceptual framework defined by Van Dyne et al.²⁵ concluding that silence and speaking
190 up are separate, multidimensional constructs, which are mainly distinguishable by the different
191 motivations from an individual to withhold voice versus speaking up. However, most of the prior
192 studies focused either on speaking up or on withholding voice.^{4,5,23,26} Our empirical results confirm
193 our approach to assess both theoretical constructs, speaking up and remaining silent.

194 The developed questionnaire is sensitive to discriminate between behavioral patterns in different
195 groups. As according to prior research^{3,27} nurses compared to doctors, and HCWs without compared

196 to HCWs with managerial function reported more frequently having had safety concerns and
197 withholding voice.
198 Barriers towards speak up were widely examined in the past,^{6,14,28,29} and in our study the ranking of
199 the 6 barriers as well as the reported frequencies of barriers differed between hierarchical groups.
200 This may be explained by the fact that the interaction between individual and organizational factors,
201 including the history between people, and the setting of the complex organizational environment
202 and dynamics may differ by hierarchical position.¹⁸ Assessing barriers via our short questionnaire
203 provide HCOs with practical indicators for the implementation and monitoring of possible
204 interventions affecting safety culture. For example, our results confirm prior qualitative evidence⁷
205 that speaking up in the presence of patients and family seems to be a common concern and could be
206 addressed by hospital wide guidance.

207 Additionally, with our vignette, we aimed to assess a situation which could potentially happen to
208 nearly all nurses and doctors working in a hospital. Vignettes are valid tools for assessing attitudes
209 and behavior^{27,30} and their advantage is that respondents answer to a standardized situation, which
210 means the results are less contaminated by differences in vaguely imagined or past experienced
211 situations.

212 *Speak up-related climate assessments*

213 Based on data analyses, our questionnaire covers 3 speaking up climate-related subscales:
214 psychological safety for speaking up, encouraging environment and resignation.
215 Psychological safety is positively related to personal engagement in work, team learning
216 engagement, giving and seeking feedback, and it enables team members to bring up concerns.³¹ As
217 expected, we observed significant differences between doctor vs. nurses and HCWs with vs. HCWs
218 without managerial, such as that a higher hierarchical level was positively associated with
219 psychological safety. These results are supported by research,^{3,4,32} and thus, our selected items are
220 considered valid and appropriate, also to identify gaps between different groups within a HCO.

221 The PSS discriminated from the EES in the PCA. While the PSS addresses the more cultural conditions
222 of a HCO, whereas EES captures the perception of HCWs towards being encouraged by colleagues
223 and supervisors as well as in the observation of others speaking-up, thus, representing daily
224 experiences related to speak up. As leadership style is known to affect team performance³³ and
225 safety culture³⁴ this scale could become an important tool to evaluate change after interventions
226 enabling leaders to encourage HCWs without managerial function to speak up.

227 Furthermore, RES was clearly confirmed as a single construct by the PCA and differences between
228 professions and managerial functions were highest among the 3 climate scales. The high level of

229 resignation among staff, i.e. nurses, is alarming. HCOs need to pay attention to and work on reducing
230 resignation in order to integrate each staff member's capacity to identify and thus, avoid medical
231 errors. The importance to include resignation in assessing speaking up is also substantiated by
232 previous research: a recent metasynthesis of 11 qualitative research studies identified four themes
233 playing a major role for withholding voice and reported the past experience of ineffective speaking
234 up being a main driver for remaining silent in the future.³

235 *Correlations between speak up-related behavior and climate scales*

236 The results of our correlation analysis confirm that the reported behaviors are connected to
237 perceived climate but also suggest that the relation between climate- and speaking up and silence
238 are not the same. All climate related scales were more strongly correlated with silence as compared
239 to speaking up. In particular, higher levels of psychological safety and encouraging environment are
240 associated with lower frequencies of withholding voice but not with higher frequencies of speaking
241 up. Thus, different factors seem to be important for speaking up behavior than for withholding voice;
242 again, confirming our decision to include "silence" as a decent construct in our survey. The result that
243 resignation is positively correlated with both, withholding voice and speaking up is surprising and we
244 could only speculate on explanations. But obviously, frequently speaking up and withholding voice.

245 **Strengths and Limitations**

246 Up to our knowledge there is no tool that combines a wide spectrum of speak up related behaviors
247 and climate aspects in a single questionnaire. A major strength is that the questionnaire was tested
248 in doctors and nurses and can be self-administered in all HCWs, who have contact to patients. As it is
249 fairly short, the questionnaire can be used for baseline measurement as well as for evaluation after
250 possible interventions.

251 The power of our results may have been underestimated, as only complete cases were analyzed for
252 the structure of the factors. However, as the MCAR assumption was confirmed and the number of
253 cases with missing data was small, the deletion of incomplete cases does not introduce any bias.
254 Nonresponse bias cannot be ruled out, but as the distribution between doctor and nurses and other
255 demographic factor are similar to the distribution in the general hospital population, this may have
256 not affected the results. A further limitation is a possible recall bias, but as frequencies were assessed
257 only over the last 4 weeks, recall bias was minimized.

258 **Conclusions**

259 With this questionnaire HCOs can assess and evaluate systematically important aspects of speaking
260 up, which allows for identifying needs and designing possible interventions to improve speaking up,

261 which finally will increase patient safety. This questionnaire has been tested in the German-speaking
262 part of Switzerland, and in a further step the questionnaire will be validated in other Swiss languages
263 (French, Italian) and in other countries and languages (Germany, UK). This will allow for valuable
264 cross-country comparisons of speaking up behaviors and climate.

265

266 **Conflicts of Interest:**

267 The authors declare no conflict of interest

268

269

270 **Figure Legend:**

271 **Fig. 1:** Means of the psychological safety-, encouraging environment-, and resignation scale stratified
272 by profession and managerial function

273 **Fig. 2:** Frequencies of reported barriers towards speak-up for the total group, and stratified by
274 profession and hierarchy

275

276 **References**

277 1. Kohn LT, Corrigan J, Donaldson MS. *To Err Is Human : Building a Safer Health System.*; 2000.

278 2. Kavanagh KT, Saman DM, Bartel R, et al. Estimating Hospital-Related Deaths Due to Medical
279 Error. *J Patient Saf.* 2017;13(1):1-5. doi:10.1097/PTS.0000000000000364.

280 3. Morrow KJ, Gustavson AM, Jones J. Speaking up behaviours (safety voices) of healthcare
281 workers: A metasynthesis of qualitative research studies. *Int J Nurs Stud.* 2016;64:42-51.
282 doi:10.1016/j.ijnurstu.2016.09.014.

283 4. Schwappach DLB, Gehring K. Frequency of and predictors for withholding patient safety
284 concerns among oncology staff: A survey study. *Eur J Cancer Care (Engl).* 2014;24(3):395-403.
285 doi:10.1111/ecc.12255.

286 5. Martinez W, Etchegaray JM, Thomas EJ, et al. "Speaking up" about patient safety concerns

- 287 and unprofessional behaviour among residents: validation of two scales. *BMJ Qual Saf.*
288 2015;671-680. doi:10.1136/bmjqqs-2015-004253.
- 289 6. Okuyama A, Wagner C, Bijnen B. Speaking up for patient safety by hospital-based health care
290 professionals: a literature review. *BMC Health Serv Res.* 2014;14(1):61. doi:10.1186/1472-
291 6963-14-61.
- 292 7. Schwappach DLB, Gehring K. "Saying it without words": a qualitative study of oncology staff's
293 experiences with speaking up about safety concerns. *BMJ Open.* 2014;4(5):e004740.
294 doi:10.1136/bmjopen-2013-004740.
- 295 8. Lyndon A, Sexton JB, Simpson KR, et al. Predictors of likelihood of speaking up about safety
296 concerns in labour and delivery. *BMJ Qual Saf.* 2012;21(9):791-799. doi:10.1136/bmjqqs-2010-
297 050211.
- 298 9. Barzallo Salazar MJ, Minkoff H, Bayya J, et al. Influence of surgeon behavior on trainee
299 willingness to speak up: a randomized controlled trial. *J Am Coll Surg.* 2014;219(5):1001-1007.
300 doi:10.1016/j.jamcollsurg.2014.07.933.
- 301 10. Robbins J, Scheck McAlearney A. Encouraging employees to speak up to prevent infections:
302 Opportunities to leverage quality improvement and care management processes. *AJIC Am J*
303 *Infect Control.* 2016;44(11):1224-1230. doi:10.1016/j.ajic.2016.03.007.
- 304 11. Davenport DL, Henderson WG, Mosca CL, et al. Risk-Adjusted Morbidity in Teaching Hospitals
305 Correlates with Reported Levels of Communication and Collaboration on Surgical Teams but
306 Not with Scale Measures of Teamwork Climate, Safety Climate, or Working Conditions. *J Am*
307 *Coll Surg.* 2007;205(6):778-784. doi:10.1016/j.jamcollsurg.2007.07.039.
- 308 12. Dankoski ME, Bickel J, Gusic ME. Discussing the undiscussable with the powerful: why and
309 how faculty must learn to counteract organizational silence. *Acad Med.* 2014;89(12):1610-
310 1613. doi:10.1097/ACM.0000000000000428.

- 311 13. Slootweg IA, Scherpbier A, van der Leeuw R, et al. Team communication amongst clinical
312 teachers in a formal meeting of post graduate medical training. *Adv Heal Sci Educ.*
313 2016;21(1):207-219. doi:10.1007/s10459-015-9627-8.
- 314 14. Schwappach DL, Gehring K. Trade-offs between voice and silence: a qualitative exploration of
315 oncology staff's decisions to speak up about safety concerns. *BMC Health Serv Res.*
316 2014;14(1):303. doi:10.1186/1472-6963-14-303.
- 317 15. Detert, Burris, Dutton, et al. Making the Decision to Speak Up or to Remain Silent:
318 Implications for Organizational Learning. *Detert & Edmondson*. 2007.
- 319 16. Singer SJ, Gaba DM, Falwell A, et al. Patient Safety Climate in 92 US Hospitals. *Med Care.*
320 2009;47(1):23-31. doi:10.1097/MLR.0b013e31817e189d.
- 321 17. Liao JM, Thomas EJ, Bell SK. Speaking up about the dangers of the hidden curriculum. *Health
322 Aff (Millwood)*. 2014;33(1):168-171. doi:10.1377/hlthaff.2013.1073.
- 323 18. Szymczak JE. Infections and interaction rituals in the organisation: clinician accounts of
324 speaking up or remaining silent in the face of threats to patient safety. *Sociol Health Illn.*
325 2016;38(2):325-339. doi:10.1111/1467-9566.12371.
- 326 19. Manser T, Brösterhaus M, Hammer A. You can't improve what you don't measure: Safety
327 climate measures available in the German-speaking countries to support safety culture
328 development in healthcare. *Z Evid Fortbild Qual Gesundhwes.* 2016;114:58-71.
329 doi:10.1016/j.zefq.2016.07.003.
- 330 20. Gehring K, Mascherek AC, Bezzola P, et al. Safety climate in Swiss hospital units: Swiss version
331 of the Safety Climate Survey. *J Eval Clin Pract.* 2015;21(2):332-338. doi:10.1111/jep.12326.
- 332 21. Colla JB, Bracken AC, Kinney LM, et al. Measuring patient safety climate: a review of surveys.
333 *Qual Saf Health Care.* 2005;14(5):364-366. doi:10.1136/qshc.2005.014217.

- 334 22. Prümper J, Hartmannsgruber K, Frese M. KFZA. Kurzfragebogen zur Arbeitsanalyse. *Zeitschrift*
335 *für Arbeits- und Organ.* 1995;39(3):125-132.
- 336 23. Tangirala S, Ramanujam R. Employee silence on critical work issues: The cross level effects of
337 procedural justice climate. *Pers Psychol.* 2008;61(1):37-68. doi:10.1111/j.1744-
338 6570.2008.00105.x.
- 339 24. Garson GD. *Missing Values Analysis and Data Imputation.*; 2015.
- 340 25. Dyne L Van, Ang S, Botero IC. Conceptualizing Employee Silence and Employee Voice as
341 Multidimensional Constructs. *J Manag Stud.* 2003;40(6):1359-1392. doi:10.1111/1467-
342 6486.00384.
- 343 26. Manapragada A, Bruk-Lee V. Staying silent about safety issues: Conceptualizing and measuring
344 safety silence motives. *Accid Anal Prev.* 2016;91:144-156. doi:10.1016/j.aap.2016.02.014.
- 345 27. Schwappach DLB, Gehring K. Silence that can be dangerous: A vignette study to assess
346 healthcare professionals' likelihood of speaking up about safety concerns. *PLoS One.*
347 2014;9(8). doi:10.1371/journal.pone.0104720.
- 348 28. Landgren R, Alawadi Z, Douma C, et al. Barriers of Pediatric Residents to Speaking Up About
349 Patient Safety. *Hosp Pediatr.* 2016;6(12):738-743. doi:10.1542/hpeds.2016-0042.
- 350 29. Beament T, Mercer SJ. Speak up! Barriers to challenging erroneous decisions of seniors in
351 anaesthesia. *Anaesthesia.* 2016;71(11). doi:10.1111/anae.13546.
- 352 30. Boenink A, Oderwald A, Jonge P De. Assessing student reflection in medical practice. The
353 development of an observer-rated instrument: Reliability, validity and initial experiences.
354 *Medical.* 2004.
- 355 31. Aranzamendez G, James D, Toms R. Finding Antecedents of Psychological Safety: A Step
356 Toward Quality Improvement. *Nurs Forum.* 2015;50(3):171-178. doi:10.1111/nuf.12084.

- 357 32. Srivastava R. Speaking Up — When Doctors Navigate Medical Hierarchy. *N Engl J Med.*
358 2013;368(4):302-305. doi:10.1056/NEJMp1212410.
- 359 33. Hu Y-Y, Parker SH, Lipsitz SR, et al. Surgeons' Leadership Styles and Team Behavior in the
360 Operating Room. *J Am Coll Surg.* 2016;222(1):41-51. doi:10.1016/j.jamcollsurg.2015.09.013.
- 361 34. Zohar D. Thirty years of safety climate research: Reflections and future directions. *Accid Anal
362 Prev.* 2010;42(5):1517-1522. doi:10.1016/j.aap.2009.12.019.

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Tab. 1: Characteristics of the study sample

Total, n		523
Hospital 1, n (%)		295 (56.4)
Hospital 2, n (%)		228 (43.6)
Males, %		17
Age, mean (SD) years		37.7 (11.2)
Profession	Nurse	73.0
	Nurse in training	4.2
	Junior Health Professional	9.2
	Nurse	46.7
	Nursing expert	8.2
	Head Nurse	4.8
	Doctors	24.7
	Resident	9.4
	Attending	6.5
	Senior and Chief	8.8
	Other	2.3
Medical area	Internal medicine, inpatient and outpatient services	26.4
	Surgery (including day-unit), orthopedics/spinal medicine	20.3
	Gynecological clinic	3.8
	Emergency	8.0
	Operating room, recovery room, anesthesia, day-unit	12.4
	Intensive care unit and neonatology	18.0
	Other clinical area	1.7
	In several areas equally	8.2
Duration of employment in this hospital	≤2 years	28.4
	>2 and ≤5 years	19.2
	>5 and ≤10 years	16.9
	>10 and ≤20 years	22.4
	>20 years	13.2
Working hours per week of patient care	<10 h	6.6
	≥10 and <24 h	26.8
	≥24 and <40 h	32.8
	≥40 h	33.9

Tab. 2: Frequencies of perceived concerns, withholding voice and speaking up for the total group, and stratified by managerial function and profession

	In everyday work, it sometimes happens that things go wrong and risks to patients arise. This could be as a result of medication error, poor hand hygiene or missing documentation. Over the last 4 weeks , how often...	At least once, %					
		n	Total	MF¹	No MF¹	Doctors	
Perceived concerns ($\alpha= 0.73$)							
PC1	... have you had specific concerns about patient safety?	522	80.3	73.4	82.1	78.3	
PC2	... have you observed an error which - if uncaptured - could be harmful to patients ?	522	62.6	59.6	63.4	63.6	
PC3	... have often have you noticed that your workplace colleagues haven't followed important patient safety rules, intentionally or unintentionally?	522	65.7	65.1	65.9	60.5	
Withholding voice ($\alpha= 0.76$)							
WV1	... did you choose not to bring up your specific concerns about patient safety?	522	35.3	22.9	38.5	26.4	
WV2	... did you keep ideas for improving patient safety in your unit to yourself?	520	33.9	22.9	36.7	24.0	
WV3	... did you remain silent when you had information that might have prevented a safety incident in your unit?	522	16.7	12.8	17.7	11.6	
WV4	... did you not address a colleague (doctors and/or nurses) if he/she didn't follow important patient safety rules, intentionally or unintentionally?	521	41.5	29.4	44.7	28.7	
Speaking up ($\alpha= 0.85$)							
SU1	... did you bring up specific concerns about patient safety?	520	77.3	78.9	76.9	74.4	
SU2	... did you address an error which – if uncaptured – could be harmful for patients ?	516	74.4	78.0	73.5	71.9	
SU3	... did you address a colleague (doctors and/or nurses) when he/she didn't follow important patient safety rules, intentionally or unintentionally?	513	66.9	65.4	67.2	57.9	
SU4	... did you prevent an incident from occurring as a consequence of bringing up specific concerns about patient safety?	504	53.8	53.9	53.8	44.8	

¹ MF: Managerial function

Tab. 3: Means and standard deviations for the hypothetical situation (vignette) for the total group, and stratified by managerial function and profession

	You are on a daily round with several doctors and nurses. During the round, the consultant doctor shakes hands with a patient. However, prior to examining the patient's wound the consultant does not apply gloves and/or does not disinfect their hands.	Total		MF¹		No MF1		Doctors		Nurses	
		Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)
VIG1	How realistic is this situation? (1=not at all, 7=very realistic) <i>p-Value</i> ²	5.32	(1.80)	4.86	(0.20)	5.44	(0.09)	4.51	(0.18)	5.58	(0.08)
							<0.05				<0.001
VIG2	If nobody acts, how dangerous do you think this situation is for the patient? (1=not dangerous at all, 7=very dangerous) <i>p-Value</i> ²	5.50	(1.27)	5.16	(0.14)	5.58	(0.06)	4.80	(0.12)	5.72	(0.06)
							<0.05				<0.001
VIG3	How likely is it that you try to alert the consultant to the missed hand disinfection/gloves (using words or gestures)? (1=very unlikely, 7=very likely) <i>p-Value</i>	4.66	(1.98)	5.58	(0.14)	4.42	(0.10)	4.89	(0.15)	4.59	(0.10)
							<0.001				<i>n.s</i>
VIG4	Would you feel uncomfortable to instruct the consultant to disinfect their hands/ wear gloves? (1=not at all uncomfortable, 7=very comfortable) <i>p-Value</i> ²	4.10	(2.09)	2.92	(0.17)	4.40	(0.10)	3.49	(0.16)	4.29	(0.11)
							<0.001				<0.001

¹ MF: Managerial function

² One-sided t-test

Tab. 4: Means, standard deviations and factor loadings for the speaking up related attitude scales

		n	Mean	(SD)	Factor loadings ²		
					F1	F2	F3
Psychological Safety for Speaking up ($\alpha= 0.84$)							
PSS1	I can rely on my colleagues (doctors and/or nurses), whenever I encounter difficulties in my work.	521	5.68	(1.21)	0.50	-0.07	-0.11
PSS2	I can rely on the shift supervisor (person in charge of a shift) whenever I encounter difficulties in my work.	522	5.75	(1.38)	0.47	0.01	-0.10
PSS3	The culture in my unit/clinical area makes it easy to speak up about patient safety concerns.	521	5.43	(1.37)	0.34	0.13	0.06
PSS4	My colleagues (doctors and/or nurses) react appropriately, when I speak up about my concerns about patient safety.	522	5.26	(1.24)	0.33	0.07	0.09
PSS5	My shift supervisors (person in charge of a shift) react appropriately, when I speak up about my patient safety concerns.	519	5.53	(1.27)	0.33	0.18	-0.02
Encouraging Environment for Speaking up ($\alpha= 0.74$)							
EES1	In my unit/clinical area, I observe others speaking up about their patient safety concerns.	522	5.29	(1.38)	-0.03	0.42	0.01
EES2	I am encouraged by my colleagues (doctors and/or nurses) to speak up about patient safety concerns.	520	4.65	(1.66)	-0.04	0.56	-0.03
EES3	I am encouraged by my shift supervisor (person in charge during a shift) to speak up about patient safety concerns.	519	4.50	(1.74)	0.01	0.53	-0.08
Resignation towards Speaking up ($\alpha= 0.73$)							
RES1	Having to remind staff of the same safety rules again and again is frustrating. ¹	517	3.96	(1.98)	-0.05	-0.10	0.69
RES2	Sometimes I become discouraged because nothing changes after expressing my patient safety concerns. ¹	519	3.18	(1.86)	0.01	0.06	0.60

¹ Negatively worded items

² Printed in bold are the rotated loadings defining the 3 components

Tab. 5: Correlations of the frequencies of speaking up and withholding voice with the attitudes-related speak up scales

	Silence Scale	Speak up Scale
Psychological Safety for Speaking up Scale	-0.53	-0.23
Encouraging Environment for Speaking up Scale	-0.36	-0.04
Resignation Scale	0.42	0.32

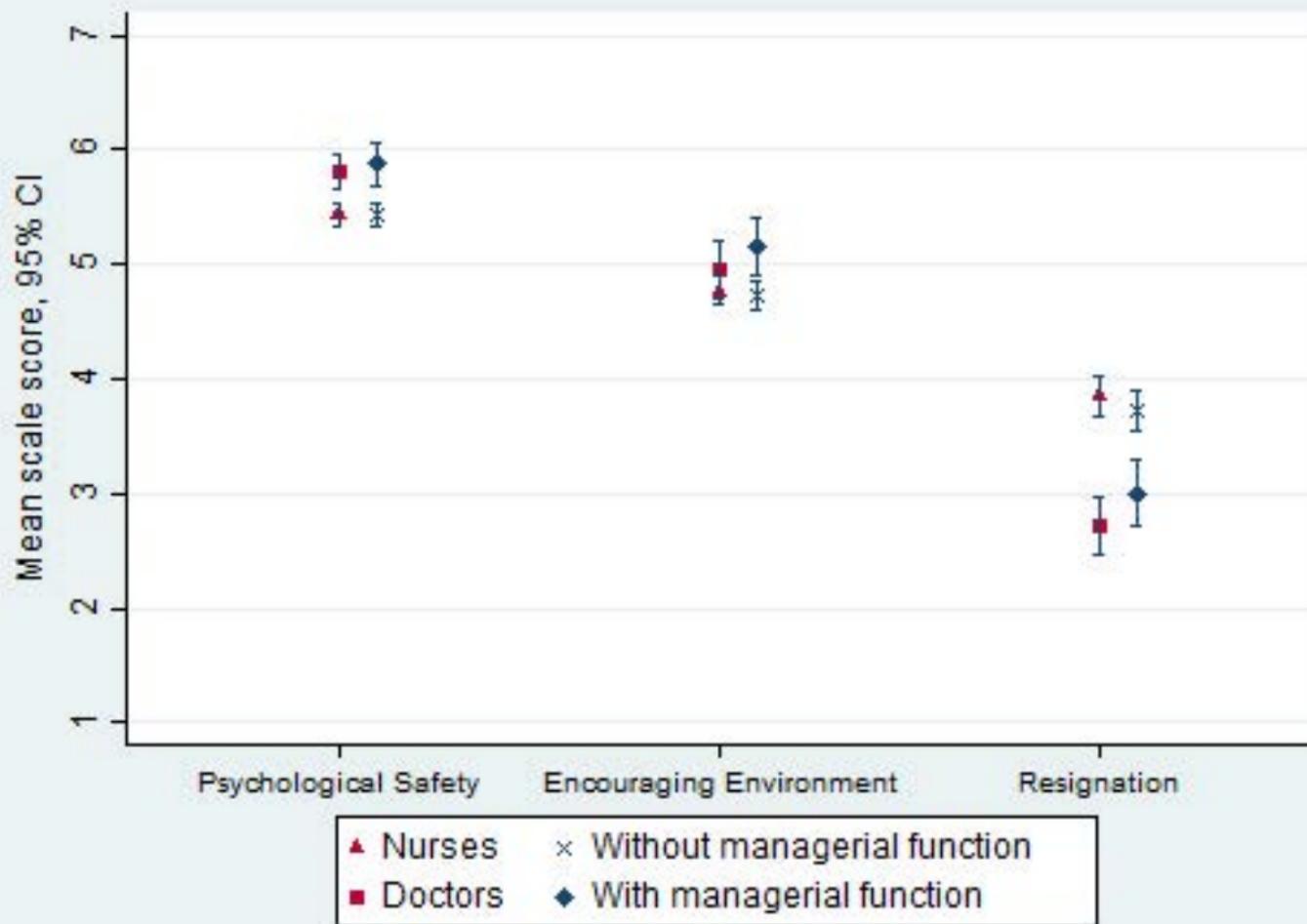


Fig. 2: Frequencies of reported barriers towards speak-up for the total group, and stratified by profession and hierarchy

