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Specialists' views on feedback at the medical workplace

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The present study aimed to explore the role of feedback in the medical workplace in the domain of radiology. Feedback is considered essential for learning, performance, and professional development, as it helps to build knowledge and skills, to correct errors, and to provide safe and autonomous patient care. Fifteen specialists were interviewed about what role feedback played in their own professional development. Moreover, we enquired about how they interact with residents and how they provide feedback in their daily work. Content analysis was used to categorise participants' answers. Results show that specialists see feedback as an omnipresent phenomenon at the workplace and perceive it as central to training. Feedback is usually provided face-to-face to reinforce and transfer knowledge, improve domain-specific knowledge, reduce mistakes, improve the outcome for the patient, change behaviour patterns, or increase social skills. Although feedback at the workplace was considered important for professional development, physicians stressed that there is often not enough time to discuss performance and possibilities for performance improvements.

Forming tandems between less and more experienced physicians, so that learning becomes more embedded in medical practice and work activities might be a facilitating condition at the workplace.

***Keywords**: feedback, medical workplace, qualitative research, learning and professional development*

Introduction

For junior physicians, residency is the first professional experience in the clinical workplace. They are on a journey towards authenticity to become independent specialists. This phase is considered one of the first and most important milestones on the path to professionalism. It is during this time that residents encounter the first challenges in everyday clinical work, practical experiences are gained and professional responsibility is assumed for the first time (Leach, 2009). The medical domain is hierarchically structured. In the medical workplace, experienced senior physicians (specialists) have to cooperate with less experienced novice physicians (residents). The workplace offers good learning opportunities if social interactions during work activities are understood as a potential source for learning (Van de Wiel et al., 2011). Especially for residents, social interactions and feedback are indispensable. Renting et al. (2016) showed that the feedback from experienced physicians influenced residents' professional knowledge and their acting at work. The present study aimed to explore the role of feedback in the medical workplace in the domain of radiology from the viewpoints of specialists.

The power of feedback at the workplace

People in working life learn in and through the context of their daily work (Simons & Ruijters, 2004). What and how people learn depends not only on the motivation and effort they invest into their development but also on the social support and interactions within the professional community (Ericsson et al., 2007; Hakkarainen et al., 2004; Lave & Wenger, 1991). The challenge at work compared to formal learning settings (e.g., at school or university) is that learning is not the main focus but rather accomplishing the required work tasks often even under time pressure. Through formal training, people have already

acquired large amounts of knowledge, which is then further developed, elaborated, and adapted by professional experience. Delving into work practices shapes and continuously reorganises cognitive structures and processes. Individuals become more and more familiar with problem-solving procedures and routines in their professional field (Boshuizen et al., 2020). Deliberate practice, integration into professional networks, and support of experienced peers who provide feedback facilitate and foster learning and professional development at work (Govaerts, 2013; Gruber et al., 2008).

As the period of residency is perceived as demanding, social support such as collegial relations and medical leadership can help reduce stress. Additionally, experienced colleagues can act as role models for professional identity formation (Mikkola et al., 2018). Social support in the form of feedback can be seen as a catalyst for learning. Van de Ridder et al. (2008) define feedback in the clinical context as "specific information about the comparison between a trainee's observed performance and a standard, given with the intent to improve the trainee's performance" (p. 193), which is similar to the feedback definition by Hattie and Timperley (2007) "information provided by an agent [...] regarding aspects of one's performance or understanding" (p. 81). According to Hattie and Timperley, effective feedback should answer three questions, namely "Where am I going?", "How am I going?", and "Where to next?". These questions address feed-up, feed-back, and feed-forward, respectively. Research indicates that feedback about the processing of the task and self-regulation is most effective for deep processing and mastery of tasks, while praise is unlikely to be effective (Hattie & Timperley, 2007; Kluger & DeNisi, 1998). However, providing feedback and receiving feedback is a complex interplay of many facets that need consideration. In a recent study, Mandouit and Hattie (2023) revisited the model of feedback (Hattie & Timperley, 2007) taking the perspective of learners into account. Interestingly, self-level feedback such as praise turned out to be more positive, especially regarding positive emotions, motivation, and confidence. Although feedback usually has a positive connotation, research has also revealed that feedback can have positive and negative effects depending on the working environment, atmosphere, and colleagues at the workplace (Mikkola et al., 2018; Van der Rijt et al., 2012). Residents value formative and continuous feedback (Chru-Hansen & McLean, 2006) and

it should aim at influencing knowledge, skill development, and acting positively (Gorniak et al., 2013; Govaerts et al., 2013; Renting et al., 2016). A large survey study in an academic medical centre (Pascarella et al., 2023) investigated preferred feedback styles and revealed that most participants value direct feedback after an activity away from their team. The initiative for feedback can come from different directions either top-down (e.g. from a feedback provider such as a supervisor) or bottom-up (e.g. from a feedback seeker such as a resident). Proactively seeking feedback was found to be related to professional development (Cheramie, 2013; Van der Rijt et al., 2012).

The present study

Since prior research in the medical domain has focused primarily on feedback recipients (Ibrahim et al., 2014; Parker et al., 2017; Sagasser et al., 2012; Teunissen et al., 2007; Tham et al., 2017; Van der Rijt et al., 2012), it seems beneficial to take a closer look at the perspectives of feedback providers. This additional viewpoint allows a more holistic understanding of feedback as a tool for supporting professional development. Radiologists can be understood as important service providers in the clinic since imaging techniques in radiology are crucial for diagnostics, which are often the prerequisite for further treatment of patients in various medical departments. With this central position in the clinic, senior radiologists play an important role in the training of residents, offering social support and giving feedback. To our knowledge, no empirical study in the domain of radiology has explored the perspectives of feedback providers. In this study, the following research question was addressed: How do specialists interact with residents and provide feedback during their daily work?

Method

Participants

A total of 24 radiology specialists were asked whether they would like to participate in this study. Fifteen radiologists (4 females and 11 males) from four hospitals agreed to be interviewed. This corresponds to a response rate of 62 per cent. All physicians who had at least one fully completed specialist training were considered radiology specialists.

In total, the participants consisted of three specialists, eleven senior physicians, and one chief physician. The mean age was 38.87 years (SD = 6.38 years), and the average work experience was 11.80 years (SD = 5.81 years). They estimated to have an average of 53.38 working hours per week (SD = 11.06 hours) and indicated that the team consisted of approximately 11 residents (M = 11.33, SD = 6.44 residents). The participating radiologists will be referred to using the abbreviations R1–R15.

Procedure

A qualitative case study methodology was used, in which radiologists were treated as a set of individual cases to explore their experiences and perceptions about feedback at work in detail (Robson, 2002). In line with Miles and Huberman (1994), a case was understood as "a phenomenon of some sort occurring in a bounded context" (p. 25). The epistemology that guided this qualitative case study was constructivism (Yazan, 2015). As a method to elicit depth and richness of participants' experiences a semi-structured interview consisting of five parts was developed. First, general information such as age, work experience, and working hours was collected. Second, questions about the role of feedback during their residency and their professional development were asked to find out whether and how experiences shaped them (e.g., "What was important for you as a resident for your professional development?"). Third, it was enquired how the participants interact with residents in their daily practice (e.g., "What is the importance of professional exchange with residents for you?"). Fourth, in the main part of the interview, the focus was on the role of feedback and how the participants provide feedback at the workplace (e.g., "With what aim do you give feedback?"). Fifth, recommendations for medical practice and professional development were provided (e.g., "How do you think the feedback process can be improved?"). During the interview, all participants were asked to illustrate their answers with examples to provide detailed information.

Participation was voluntary and all participants gave their written consent in advance of the interview. The APA Ethical Principles of Psychologists and Code of Conduct were followed. In case of an agreement to participate, a personal appointment was made. The interviews were recorded and then transcribed verbatim. An interview

lasted an average of 37.78 minutes (SD = 12.58 minutes).

Analysis

The analysis aimed to derive findings from the interview data to describe and interpret medical feedback and social interactions in the radiology workplace. Content analysis was used to categorise participants' answers. A combination of deductive and inductive content analysis was used to achieve the best possible category formulation and data explication. Analysis proceeded in an iterative process. The deductive content analysis started with the main themes and activities addressed by the questions (own professional development, interactions with residents, role of feedback at work, and recommendations for medical practice). Answers were grouped based on these themes and further categorised into subthemes that emerged from the data (e.g., feedback during own residency, ambition or goal-directed activities). Based on the classification of the data into subcategories, codes were generated (e.g., subcategory feedback during own residency, codes: form, person, way of learning, benefits, help, best feedback, worst feedback). The coding was theory-driven. The data in each subcategory was summarised, and similarities and differences in statements were identified.

Findings

Own professional development

All participants saw their residency as a good opportunity to develop professionally and they talked about various goal-directed activities. Four radiologists mentioned taking their initiative early on (e.g., reading specialist literature and working on interesting cases) and advanced training during their residency was perceived as essential. For three interviewees, it was particularly important to encounter the radiological spectrum of services as comprehensively as possible, to see rare diseases and to participate in as many examinations as possible. Three other participants looked for versatile colleagues and medical role models in their environment to learn as much as possible from them.

> *What got me the most was when someone was enthusiastic about what s/he was doing. That, yes, a passion. If that coincided with my interests, then it motivated me strongly. (R12)*

For three interviewees, it was particularly important to have ample opportunities for research and scientific work as well as the possibility for further training outside the clinic during their residency. Independent diagnostic work as well as taking on responsibility were stressed by three radiologists as relevant for their professional development. Two participants indicated the communication with colleagues and practical medical activities, as well as the opportunity to apply knowledge and reflect on their performance afterwards.

Feedback during their residency was perceived differently by the radiologists. Nine participants received verbal feedback at the workplace relatively quickly and directly during or after the diagnostic reasoning and reporting process. Five participants explained that they had to describe their diagnostic findings to a senior physician, who then either agreed with their proposed diagnosis or corrected the resident by stating a different finding. For four interviewees, these feedback situations took place daily. Most of the participants rated this form of feedback as constructive.

> *I think that feedback improved my diagnostic quality as I received additional information. […] I also gained much through looking up information, reading, and asking. (R6)*

> *He showed me how to do it right. Copying him was the learning effect. (R9)*

> *Logically it helps if you have the appraisal of someone who knows a lot. That gives you certainty, I think. (R12)*

Seven participants indicated having received negative feedback in the form of a critique when an action in the workplace needed improvement, while seven other participants mentioned having received little to no feedback during their residency. Occasionally, six radiology specialists experienced positive feedback in the form of praise when something went well. However, most participants said that no feedback could be considered positive feedback.

> *You often only get to know what is going badly or not going well and usually not what you could improve and how. (R 14)*

> *Well, I was either criticised or nothing was said. Very rarely I got*

praise. (R11)

If something went well, you never really got any feedback. (R15)

Overall, feedback during the residency was seen as good preparation for later independent specialist work. Twelve participants found feedback helpful, especially about improving radiological differential diagnostic skills and the quality of radiological reporting. For three radiologists, feedback from experienced colleagues was helpful for further motivation and confidence in radiological work. Feedback in general played an elementary role in medical training for two interviewees. Three participants saw a positive effect on social aspects in the workplace through the provision of feedback (e.g., communication with other colleagues or the realisation of cooperative successes). One interviewee perceived the feedback providers as role models for his later interaction with residents. Only one person thought that there was no helpful feedback during his residency.

In their current role, the radiologists mentioned the following goal-directed activities to develop themselves professionally and to stay up to date: reading, practising (related to angiography), interdisciplinary exchange, interacting with colleagues, and advanced training. Only one participant faced a lack of time to pursue goal-directed activities to further support his professional development.

I exchange with my colleagues; we are very open. We talk very straight and directly about many things. That is most important for my professional development. (R11)

At present, interdisciplinary exchange, international conferences, and further training are important. (R14)

Interactions with residents

All respondents indicated that professional exchange and the training of residents is one of the central tasks of a clinic. The radiology specialists see their responsibility in the professional supervision of residents (e.g., support to prevent insecurity, guidance, or instruction during medical examinations, being a contact person in the background) and quality assurance at the workplace. Residents were perceived as members

of the team fulfilling an essential role. For fourteen participants the professional exchange with residents mainly occurs in those situations that require a diagnostic report, and these interactions were experienced as beneficial because specialists also gain new information themselves. For four interviewees, the exchange also takes place during morning meetings, interventions, and examinations. Three interviewees also spoke of direct interactions with residents during radiological demonstrations as well as educational courses, in which fundamental knowledge is taught or reviewed (especially at the beginning of residency).

> *The guidance of the medical examination: How does it work? Which technique to use in a particular case? Then the resident will gradually carry out this examination independently. (R1)*

> *I must be readily available for the residents in case they have questions, or I check whether the diagnostic findings are correct. (R9)*

> *Naturally, I also always learn something new. Sometimes, residents know something, I did not know. (R4)*

Role of feedback

For all participants, feedback at work played a very important role as it contributes to learning and further development. They understood feedback as a kind of response or acknowledgement related to accomplishments, actions, or work performances. For two participants feedback was also seen as a means of assessment or confirmation.

> *Feedback is the central element of the training. (P4)*

> *[Feedback is] Any kind of response related to diagnostic findings and treatment of patients. (R15)*

> *Feedback to me is providing information for my counterpart related to an action or a performance. Essentially, also something I assess. (R10)*

Positive feedback as mentioned by eight interviewees was related to praise with an emphasis on a well-done performance or action associated with positive terms like "good" or "wonderful". For

five participants, positive feedback was seen as reinforcement or confirmation.

> *Positive feedback would be when I say: wonderful. Nothing more to add, nothing more to improve. (R3)*

> *Positive feedback for me is, in some form a reinforcement. That it is important what has been done as well as desirable from my point of view and that it should be continued in this form. (R11)*

Ten radiologists described negative feedback as a form of criticism stressing a poor performance, which is ideally connected with corrective feedback that points out mistakes, provides suggestions for improvement, and clarifies expectations.

> *For me, negative feedback means that I emphasise something he did badly. Negative feedback in terms of gradations, what he has done badly. That means drawing attention to a mistake such as "Here you have overlooked something". And that's 95 per cent of the feedback. (R10)*

> *Comments like: "Why did you do this examination? That was total nonsense! You should not have done it!" without elaborating any further. Negative feedback is, in that sense, negative information. However, it must be presented understandably, because, of course, you grow from it. (R6)*

Interviewees distinguished between feedback that happens daily in small conversations along the way (e.g., diagnostic reporting) and feedback in the context of employee appraisals, which are planned meetings (e.g., once, or twice a month, once a year) that focus on the individual work performance and progress. Three radiologists mentioned giving face-to-face feedback directly in a friendly manner and suggesting points for improvement. Nine interviewees stated to give feedback verbally, and occasionally also in written form. They preferred a constructive approach with a combination of positive and negative feedback. Moreover, they indicated trying to understand why residents acted in a certain way. Some of them admitted that they find it sometimes difficult to mention positive aspects during their feedback. Two interviewees said that they decide spontaneously what kind of feedback is most suitable depending on the situation.

> *I try to teach them things. This can be done through positive or*

> *negative feedback. I think you have to develop a sense of whether positive or negative feedback is best for the candidate. (R4)*

All interviewees stressed that the aim of providing feedback should be to support the residents in their radiological work and to foster their professional development. Seven interviewees considered positive reinforcement, improvement, and transfer of domain-specific knowledge as crucial. For five participants, the goal of their feedback was to avoid mistakes in the future. Another five radiologists focussed on improving the residents' professional knowledge and increasing their social skills so that they become good physicians and colleagues. Three respondents wanted to convey that the quality of the work must be optimal to improve the outcome for the patients and to represent the respective institute. Two interviewees attached importance to either confirming residents in their actions or changing their behaviour.

To achieve these aims, radiologists mentioned tailoring their feedback to residents' work experience as well as to their personalities. Eight interviewees thought that it is important to take the years of residency into account when giving feedback. These interviewees were convinced that inexperienced colleagues (e.g., residents in their first year) should receive more feedback. Three other radiologists thought that previous clinical experience was a decisive criterion for the type of feedback. Instead of work experience, four participants thought more about residents' personalities when giving feedback. In their opinion, the acceptance of and reaction to feedback was more related to individual factors. Seven radiologists had the impression that residents deal differently with negative and positive feedback, but predominantly they rated the handling of feedback as positive. The participants also experienced gratitude and joy from the residents about the feedback given.

> *I differentiate the profoundness of my feedback based on the educational attainment of the residents. […] Another aspect that is very important when providing feedback is the personality of the residents. (R15)*

> *Yes, some residents float in the clouds when they receive positive feedback and think they are the greatest. But there are also residents, who want to throw themselves off the next bridge*

> *when they get negative feedback. [...] That is very, very different from person to person. You see completely different reactions to the same kind of feedback. Yes, I think it depends on the personality of the individual doctor. (R10)*

For seven participants it was important to tell the feedback recipients that their feedback is not about personal, but rather professional matters, about the content of the feedback message to be conveyed. Three radiologists emphasised that one should be polite when giving feedback, being nice and friendly despite the other person's mistakes and showing appreciation.

> *I always try to be nice and friendly. Even if there are mistakes, I try not to annoy them or show them up in any way - or say: "How stupid can you be?" - but to remain polite. That is important to me. (R2)*

Seven participants said to prepare themselves for feedback conversations, but rather briefly and mentally, especially in cases of planned appraisal interviews, exceptional situations, or written feedback. During preparation, they indicated to focus on the goals and the order of topics to be discussed in their feedback. Eight interviewees mentioned that they do not prepare themselves for giving feedback, because it usually happens spontaneously during daily discussions about diagnostic findings. Giving feedback was also associated with providing all kinds of hints to foster residents' learning and professional development. For instance, seven radiologists mentioned that they inform residents about specific textbooks or scientific articles, while three participants said to advise about further training events and relevant medical contacts. Two participants indicated making their materials from congresses or further education available. However, three interviewees explicitly stated that they expect residents to be proactive and show initiative in self-study to progress professionally. Twelve participants thought that residents ask actively for feedback, especially to clarify uncertainties and questions regarding diagnostic processing, procedures, findings, and reporting. According to them, residents seek confirmation. Surprisingly, the participants stated that they were not asked to provide feedback.

> *I try to focus on where I want to go with the resident. What we*

> *want to achieve together. What we want to learn and need to improve further. (R11)*

> *There must be a will to read further independently. We are no longer in school, where I would say "Now read this book, otherwise…". We are in working life. (R7)*

To monitor whether the provided feedback is also implemented, the participants indicated different strategies. Two radiologists mentioned that they ask residents questions afterwards. For eleven participants, the verification is carried out by observing the errors of the residents directly during the preparation, review, and approval of the findings. While five participants said to check systematically, the other ten mentioned doing that occasionally.

Eight interviewees expressed the feeling that giving feedback is usually positive. Five participants explicitly stated that they enjoyed providing feedback, but finding enough time was perceived as challenging. For four interviewees giving feedback was seen as a professional part of their daily work without any particular feeling involved. In contrast, three interviewees experienced providing feedback as rather demanding and initially even found it unpleasant, especially when it concerned more social, personal feedback.

> *It is difficult. For instance, if I have to correct my specialist colleagues. If I see something, specialists have not noticed. Then I need to inform them like "Listen, you have overlooked something here". I always find that difficult. (R2)*

> *It was much harder for me at the beginning than it is now. Of course, I was not used to getting positive feedback during my training. You have to rethink and say: Yes, but it is a good thing, and it is important. (R8)*

Seven participants stated that they have attended training, in which the topic of feedback was addressed at least to some extent. Five of them evaluated this training as helpful, while two persons could not take away much knowledge for their daily work. The eight radiologists who had not yet attended a course about feedback thought it could be useful, especially in difficult situations (e.g., correcting a superior).

> *I often do not know what the right way is if someone did something wrong. Then, I cobble something together, in a way I think is somehow humane. Professional instruction on how to best do that would be valuable. (R13)*

Recommendations for medical practice

Seven interviewees would welcome more structure in the provision of feedback and stressed the importance of standardisation so that feedback discussions can take place regularly. Also scheduling more time for feedback was explicitly mentioned. In addition, the provided feedback should be noted down in brief so that one can easily refer to it at a later point in time. Two radiology specialists suggested a process optimisation in reporting and feedback, by which direct feedback can be given immediately to the residents with each electronic report, thus after the diagnostic process.

> *You could really improve the feedback practice if you implement it in our routines, really standardising it. For instance, if a new resident starts you inform her/him that there will be a feedback moment after, let's say, two months with a particular specialist. (R11)*

> *At the end of the day, the way things are going now is not very systematic. There are six senior physicians, and they all want something different, they all attach importance to something else, which is overwhelming for residents. [...] What would make sense is to define standards together somehow, so that the residents know, okay, this is good, this is bad, this is what is desired. (R13)*

All participants agreed that professional exchange with residents in the radiology workplace is important. To be well prepared for this task, five participants recommended that colleagues educate themselves, stay up-to-date, and perceive the exchange as a good learning opportunity for themselves. Two participants mentioned that senior physicians should act professionally, maintain their neutrality without judging another person, consider the level of training, and be more open about sharing their knowledge with colleagues. This is in line with eight participants, who emphasised the benefit of compulsory training about feedback for

all senior physicians as it would increase the quality of feedback. Finding a balance between positive and negative feedback (with a tendency to be more positive), as well as conveying security on the one hand and allowing independence on the other hand was perceived as important but also as challenging. One interviewee stressed the need to balance digital and face-to-face exchanges and to sit down with residents - especially in the beginning - to observe them and explain as much as possible.

> *I think giving feedback is important. I think you should do it at the level where it comes across. For me, it is the level of "collegial". [...] You should give both positive and negative feedback. (R6)*

> *I think that you often ask yourself the question of how to provide negative feedback. There is, I think, a great discrepancy between colleagues. (R7)*

For professional development, ten participants advised residents to be curious, to do research, to read a lot, to actively ask questions and ask for feedback, to be diligent, to stay attentive at work and to take in as much information as possible. Four interviewees recommended taking a broad professional approach and following one's interests and gut feelings. Furthermore, four participants pointed out that it is important to choose good medical colleagues with whom one enjoys working together and to orient oneself towards these good medical colleagues to learn as much as possible.

Discussion

In this qualitative case study, semi-structured interviews were used to explore the views and perspectives of radiologists about feedback to gain a deeper understanding of how specialists interact with residents and provide feedback during their daily work. The interview covered radiologists' experiences during their residency as well as their current work practices with residents.

The look into their past and their professional development revealed quite some differences. While some reported positive experiences with highly engaged feedback providers, others were rather critical about the feedback they had received. They had the impression that feedback was

formulated rather negatively and vague without specific suggestions for improvement to support learning. Taking initiative and independence were therefore perceived as all the more important for one's professional development. From a learning perspective, this viewpoint can be questioned, because it might intervene with working closely together with experienced colleagues, who could foster deliberate practice and critical reflection (i.e., Cordero et al., 2013). Moreover, social support has been found to reduce stress and influence professional identity (Mikkola et al., 2018). Additionally, proactive behaviour like actively seeking feedback has been identified as an essential tool for professional development (Cheramie, 2013; Van der Rijt et al., 2012).

When reflecting on their current work practices with residents, the participating radiologists expressed that feedback was an omnipresent phenomenon at the workplace and they experienced it as a central element of training and professional development. This is in line with the results of the study conducted by Gorniak et al. (2013), where feedback from experienced colleagues in the medical workplace is understood as an important factor for the development of radiological reporting skills. Furthermore, research shows that social interactions at the workplace can enhance learning and interprofessional interactions are significant for the further professional development of all persons involved (Goldman et al., 2015; Mikkola et al., 2018; van de Wiel et al., 2011). It is evident from our participants' answers that social interactions with residents are an inherent part of their everyday professional work. The interviewees valued such interactions as beneficial and instructive, also because they can occasionally gain new information themselves and expand their knowledge. Moreover, the radiologists mentioned that professionalism is important during social interactions meaning that conversation partners should prevent expressing personal opinions or judgements.

Despite the appointed importance of feedback, only half of them had followed formal training about providing feedback or a related topic. Thus, their own experiences were the basis for their way of acting. Feedback was usually provided face-to-face and for most participants, feedback takes the form of small daily comments on the radiological reporting activity. This finding corresponds to the direct feedback preferences that were revealed in the study by Pascarella et al. (2023). The radiologists generally equated positive feedback with praise, but

according to them, this did not happen often enough. Research in the academic context has indicated that praise or self-level feedback was least effective for learning in comparison to feedback on task, process or self-regulation level as the information is often too vague (Hattie & Timperley, 2007; Kluger & DeNisi, 1998). However, the findings of a recent study (Mandouit & Hattie, 2023), in which the perspective of feedback receivers was considered, suggest that self-level feedback can stimulate positive emotions, motivate learners, and increase confidence and self-efficacy. Future research would have to investigate whether similar results could be replicated in workplace settings. Depending on the way feedback is provided, it can have positive and negative effects (e.g., Mikkola et al., 2018; Van der Rijt et al., 2012) and therefore careful handling is advised.

Interestingly, no feedback was also understood as positive feedback by our participants. However, this can be misleading, especially for novice radiologists, because not receiving feedback could cause uncertainty or misinterpretation of one's performance affecting self-confidence. Our interviewees indicated that they needed to develop a keen sense of what works for whom. While some radiologists enjoyed providing feedback, others found it rather challenging. Especially, in cases, in which hierarchies were involved or more personal feedback was required. Choosing the right balance between positive and negative feedback was perceived as desirable but also sometimes difficult. They tried to focus on the factual level (e.g., comments related to the diagnostic activity). Feedback was mostly given on the task level, occasionally on the process level, to improve performance and prevent errors (i.e., Govaerts et al., 2013). Providing feedback was done to reinforce, transfer knowledge, improve domain-specific knowledge, reduce mistakes, and improve the outcome for the patient, change behaviour patterns or increase social skills. Considering the three feedback questions in the model of feedback (Hattie & Timperley, 2007) related to feed-up ("Where am I going?"), feed-back ("How am I going?"), and feed-forward ("Where to next?"), our findings suggest that radiologists mainly focus on feed-back and feed-up, while feed-forward was not mentioned. There might be different explanations. One reason could be the time pressure at work that was mentioned frequently. Another reason could be a lack of knowledge about effective feedback. As suggested by our participants, more standardisation, and a common understanding about what good

and not good feedback is, could be means to improve feedback practices at work.

Limitations, future research and practical implications

Although our study reveals valuable insights into radiologists' views and perspectives on feedback, this qualitative approach comes with several limitations. First, the sample was rather small, so the diversity of radiology specialists and hospital variety cannot be fully captured. In addition, participation was voluntary, which might have led to selection bias. When preparing the study, we had the opportunity to do some work shadowing and observations to gain a better understanding of the work practices. The collected interview data corresponded to what we experienced. However, caution is advised, because the data presented in this study is based on self-reports that were not verified by other measures and participants might have been subject to give socially desirable answers. In future research, it would be valuable to combine the self-image with external perceptions, for instance, by also collecting the viewpoints of residents accompanied by observations at work. Such an approach would yield a more holistic image of the feedback practices at the medical workplace. It would also allow us to investigate how feedback can be most effective to help improve learning and professional development at time pressure sensible and labour-intensive workplaces.

The findings of our study suggest that having guidelines for the diagnostic process that are used as a kind of checklist could be a helpful tool to facilitate interactions with residents. Moreover, defining genuine rules and standards for feedback at the workplace, creating room for discussion and exchange, and communicating what is expected of the different parties involved (e.g., residents being proactive) might support more uniform and transparent acting. Forming tandems between less and more experienced physicians, so that learning becomes more embedded in medical practice and work activities could be another facilitating condition at the workplace.

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