

R. A. Kubik-Huch
R. Klaghofer
M. Römpler
A. Weber
B. Buddeberg-Fischer

Workplace experience of radiographers: impact of structural and interpersonal interventions

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R. A. Kubik-Huch (✉) · M. Römpler ·
A. Weber
Institute of Radiology,
Kantonsspital Baden,
CH-5404 Baden, Switzerland
e-mail: Rahel.kubik@ksb.ch
Tel.: +41-56-4863802
Fax: +41-56-4863809

R. Klaghofer · B. Buddeberg-Fischer
Department of Psychosocial Medicine,
Zurich University Hospital,
CH-8091 Zurich, Switzerland

Abstract Purpose: Within the framework of organisational development, an assessment of the workplace experience of radiographers (RGs) was conducted. The aims of this study were to develop structural and interpersonal interventions and to prove their effectiveness and feasibility. **Methods:** A questionnaire consisting of work-related factors, e.g. time management and communication, and two validated instruments (Workplace Analysis Questionnaire, Effort–Reward Imbalance Scale) was distributed to all RGs ($n=33$) at baseline (T1). Interventions were implemented and a follow-up survey (T2) was performed 18 months after the initial assessment. **Results:** At T1, areas with highest dissatisfaction were communication and time management for ambulant patients (bad/very bad, 57% each). The interventions addressed adaptation of

work plans, coaching in developing interpersonal and team leadership skills, and regular team meetings. The follow-up survey (T2) showed significantly improved communication and cooperation within the team and improved qualification opportunities, whereas no significant changes could be identified in time management and in the workplace-related scales ‘effort’ expended at work and ‘reward’ received in return for the effort. **Conclusion:** Motivating workplace experience is important for high-level service quality and for attracting well-qualified radiographers to work at a place and to stay in the team for a longer period.

Keywords Radiographers · Workplace experience · Intervention study · Communication · Time management

Introduction

The rapid technological improvements in radiology over the last decade have resulted in a massive rise in demand especially for cross-sectional imaging. These developments have led to an increased need not only for radiologists, but also for well-qualified radiographers. In Switzerland, as in most European countries, as well as in the USA, this has resulted in a current shortage of well-qualified personnel. It has become difficult to hire new recruits; there are many open positions and increased competition especially between public and private institutions [1, 2].

The technological development of hardware, digital data processing and the introduction of PACS (picture archiving and communication systems) in most radiology departments have had a great influence on the workplace environment in recent years. The referring physicians, patients and hospital administrators look to radiology to expedite the diagnostic process, with images and reports being available shortly after the patients are examined. Hospital administrators rely on radiology to increase the revenue through higher patient volume, which in turn requires greater efficiency and productivity from the radiographers. This rising demand for radiological services may put immense pressure on the

employees and influences the workplace environment and staff morale [3–6].

Satisfying workplace conditions are an important factor to attract well-qualified radiographers to work at a place and to stay in the team for longer periods. An institution that can provide such workplace conditions will enjoy immense competitive advantages [3, 7–9].

In our department, the renewal of almost all technical equipment, digitalisation and implementation of a PACS within a relatively short period of time together with the increasing demand for radiological services have resulted in a rapid increase in the number of radiological exams, resulting in a higher workload and therefore also higher occupational stress in the department, further accompanied by a relatively high personnel turnover. Therefore, an assessment of the workplace experience of radiographers was conducted within the framework of organisational development and quality management at our institution.

The aims of this study were to develop structural and interpersonal interventions to further improve the workplace environment. Eighteen months after the initial assessment, a follow-up survey was conducted to monitor the results of the interventions.

Materials and methods

Design and sample

Based on a hospital authority initiative of Kantonsspital Baden to improve their employees' workplace satisfaction, the following study was conceptualised by the Head of the Institute of Radiology of Kantonsspital Baden together with a research group of the Department of Psychosocial Medicine of Zurich University Hospital. In August 2007 (T1), 33 radiographers (RGs) were asked to take part in a questionnaire survey on their workplace experience, of whom 21 participated.

Whereas the RG team leaders are working in their field of specialisation only, e.g. MRI, all others RGs rotate in 1- to 3-month intervals. Our hospital runs the largest emergency department in the region; therefore besides regular radiological services for in- and outpatients, all RGs participate in night and weekend shifts for radiological emergency services.

To ensure participants' anonymity, the returned questionnaires were sent to the Department of Psychosocial Medicine of Zurich University Hospital and were identified only by a code.

Subsequently, structural and organisational interventions were developed and implemented over a 12-month period. In January 2009, the follow-up assessment (T2) was conducted. Twenty-three out of 29 RGs participated. During the study period, there had been a high employee turnover in the RG team; only nine of them (six female and three male) participated in both assessments. Therefore, the results are based on two independent samples. The study

sample is described in Table 1: most were women and the mean age is 36 years.

Instruments

The survey was performed using a three-part questionnaire: the first part consisted of 13 questions developed for this survey, the second part of well-established and validated questionnaires, and in the third part, socio-demographic data were collected.

Part 1 Based on our personal workplace experience, discussions in a focus group and a literature search on factors influencing job satisfaction, 13 indicators on two different work-related topics (communication and time management) were defined, and questions formulated accordingly. The eight indicators on the topic of communication and the five indicators on time management are listed below:

- *Communication* (four-point Likert scale: 1 very bad–4 very good):
 1. Between RGs and patients

Table 1 Description of the study sample

	T1 <i>n</i> =21 <i>n</i> (%)	T2 <i>n</i> =23 <i>n</i> (%)
Gender		
Women	17 (81)	15 (66)
Men	4 (19)	8 (34)
Age (years)		
Mean	36	37
Range	22–53	20–55
Civil status		
Single	11 (52)	11 (48)
Married	10 (48)	11 (48)
Divorced	0	1 (4)
Widowed	0	0
Children (yes)	10 (50)	13 (57)
Position		
In training	1 (5)	2 (9)
Graduate	16 (76)	16 (79)
Team leader	4 (19)	5 (22)
Employment (%)		
Mean	70	75
Range	20–100	20–100
Time since graduation (years)		
Mean	14	15
Range	1–29	1–30
Duration of employment in study hospital (years)		
Mean	6	6
Range	<1 to 20	<1 to 21

2. Among RGs
 3. Between young and older RGs
 4. Between RGs and radiologists
 5. RGs with administrative collaborators
 6. RGs with nurses of other hospital departments
 7. RGs with physicians of other hospital departments
 8. RGs with physicians from outside
- Five questions on *time management* (four-point Likert scale: 1 very low/bad–4 very high/good)
 1. Time pressure in emergency examinations
 2. Conflict between high demand and RGs' time resources
 3. Possibilities for independent organisation of free examination slots
 4. Concordance between time scheduling of ambulant patients and time resources
 5. Handling of urgent examinations exceeding capacity

Part 2 The following validated questionnaires were incorporated into the survey for both assessments:

- *Workplace Analysis Questionnaire* (Prümper [10]), abridged and adapted by Abele [11]: 14 items, five-point Likert scale, assigned to five scales: *job decision latitude* (3 items), *stress* (3), *social support* (2), *qualification opportunities* (3) and *leadership* (3).
- *Effort–Reward Imbalance (ERI) at Work Questionnaire* [12]: 17 items (five-point Likert scale), assigned to the scales *effort* (6 items) and *reward* (11 items). The items of the 'effort' scale measure an intrinsic (personal, coping-related) component of stressful experience at work, while the items of the 'reward' scale measure an extrinsic (perceived work situation) component. The effort/reward quotient is a measure of the imbalance between these two components. A value close to zero indicates a favourable condition (relatively low effort, relatively high reward), whereas values above 1.0 indicate a high amount of expended effort not equalled by the rewards received or expected in return.
- *Overcommitment* (6 items) [12] (four-point Likert scale) focuses on an excessive effort at work as evidenced by the respondent's inability to withdraw from work obligations and develop a more distant attitude towards job requirements.

Part 3 Socio-demographic data: We asked for gender, age, civil status, children (yes/no), professional position (in training/graduate/team leader), time spent in employment

in per cent, date of graduation and date of employment in study hospital.

Structural and interpersonal interventions

Based on focus group interviews with the RG team and the department superiors, the following four issues were defined:

- Interaction within the RG team
- Inconsistencies at management level (upper and middle management)
- Collaboration with radiologists within the radiology department
- Interdisciplinary collaboration with other units (e.g. nursing, emergency unit)

Based on these issues, structural and interpersonal interventions were designed and the responsibilities as well as a schedule for their implementation defined. A detailed overview over the implemented measures is given in Tables 2 and 3. For each of the issues, structural and interpersonal interventions were conducted. The latter were accompanied by a coaching process. Coaching and training within the RG team were conducted by an in-house consultant, while the individual coaching of the RG team leaders and the coaching of the department superiors was performed by external consultants.

Statistical analysis

Analyses were carried out with SPSS for Windows, release 15. Descriptive statistics are given in terms of counts and percentages, means and standard deviations, respectively. Differences between the two points in time were investigated by Chi-squared tests in categorical variables, such as the items in the areas of communication and time management. As continuous variables of workplace conditions, effort–reward imbalance and overcommitment did not deviate significantly from a normal distribution, we preferred parametric statistical procedures. We used an analysis of covariance (with gender as covariate) to analyse changes over time in these variables and additionally reported gender-adjusted means for the scales. A *p* value of less than 0.05 was considered to be significant.

Results

Communication and time management at T1

At T1, the assessment of *communication* within the professional framework revealed the following (Table 4): the area with the highest level of dissatisfaction was communication within the team (bad or very bad, 57%),

Table 2 Structural and interpersonal interventions to improve communication

Communication	Structural measures	Interpersonal measures
<i>Interaction within the RG team</i>	<ul style="list-style-type: none"> ➤ <i>Measures for team building and improvement of communication</i> <ul style="list-style-type: none"> ○ Morning meeting of all RGs and handover of the night shift ○ Weekly team meeting in the conv. radiology area with image discussions and feedback on collaboration and communication ➤ <i>Personnel development</i> <ul style="list-style-type: none"> ○ Increased involvement in advanced medical training and organisation of joint cross-departmental advanced training events ○ Encouragement of RG-specific advanced training in the department (e.g. new technologies, new MRI sequences, hygiene) ○ Recruiting and cancellation interviews supported by the personnel department ○ Targeted promotion of individual employees with selected external advanced training 	<ul style="list-style-type: none"> ➤ <i>Measures for team building and improvement of communication</i> <ul style="list-style-type: none"> ○ Coaching (group or individual coaching) with feedback on communication ○ Interventions at the social level (encouragement of joint activities like joint breakfast, drinks and snacks at the department, setup of a “sweets and snacks corner”, joint external activities, e.g. tenpin bowling, Christmas dinner, summer trip)
<i>Inconsistencies at management level (upper and middle management)</i>	<ul style="list-style-type: none"> ➤ <i>Information</i> <ul style="list-style-type: none"> ○ Meeting of the RG team leaders once a week with decision memorandum ○ Meeting of the entire RG team once a week with increased involvement of the team in decision-making processes ○ Informing the staff on a regular basis, also on strategic subjects, during the RG meeting ○ Setup of an e-mail account for each staff member and use of this medium as an information instrument ➤ <i>Transparency and improvement of the management structures</i> <ul style="list-style-type: none"> ○ Clarification of responsibilities and representation regulation for most different management tasks and role allocations, definition of interfaces, informing the staff of interfaces ○ Meeting of the physician/non-physician management on a regular basis and joint determination of measures 	<ul style="list-style-type: none"> ➤ <i>Information</i> <ul style="list-style-type: none"> ○ Optional joint weekly lunch for the team leaders and RG management ➤ <i>Transparency and improvement of the management structures</i> <ul style="list-style-type: none"> ○ Group coaching, individual coaching and leadership training of the RG team leaders ○ Leadership coaching of the department’s physician/non-physician management with the objective of developing a joint leadership understanding and being perceived by the staff as a leadership team
<i>Collaboration with the radiologists within the Institute of Radiology</i>	<ul style="list-style-type: none"> ➤ <i>Information and communication</i> <ul style="list-style-type: none"> ○ Joint 1-h meeting once a month (subjects: feedback on collaboration, processes and options for improvement, communication misunderstandings) ➤ <i>Process improvement</i> <ul style="list-style-type: none"> ○ Clear regulation of sequences and processes (e.g. mammography, visceral radiology) in order to avoid misunderstandings within the team 	<ul style="list-style-type: none"> ➤ <i>Information and communication</i> <ul style="list-style-type: none"> ○ Feedback by internal coaching with the objective of improving communication and avoiding misunderstandings ○ Joint team events physician/non-physician personnel ○ Involvement of the RGs in advanced medical training

Table 2 (continued)

Communication	Structural measures	Interpersonal measures
<i>Interdisciplinary collaboration with other units (e.g. nursing or emergency unit)</i>	> <i>Communication and process improvement</i> <ul style="list-style-type: none"> ○ Setup of a nursing/radiology workgroup with meetings on a monthly basis for discussing interdisciplinary collaboration and addressing communication and interface problems ○ Improvement of the documentation on patient preparation for examinations on the intranet ○ Determination of joint sequences, in particular their interface regulation and written documentation ○ Meetings with the head of the emergency unit on a regular basis, who also participates in the RG meeting once a month 	> <i>Communication</i> <ul style="list-style-type: none"> ○ Encouragement of professional communication and feedback on possible communication problems in the interface area

especially between young and older RGs (bad or very bad, 48%).

Concerning *time management* (Table 5), problems were identified especially in the management of ambulant patients because of limited time resources (bad or very bad, 57%).

Structural and interpersonal interventions

As described in the [Materials and methods](#) section (Tables 2 and 3), several structural and interpersonal intervention measures concerning improvement of communication and time management were developed and implemented throughout 2008: morning meetings for passing on information from the night shift, weekly team meetings of all RGs as well as team leader meetings, monthly meetings with RGs and radiologists of the department, process optimisation, coaching of RGs in developing interpersonal and team leadership skills, promoting a culture of giving and receiving feedback within the RG team; improving the time frame for radiography, delegation

of administrative tasks to administration staff, and planning of staff rosters at least 1 month in advance.

Follow-up survey

A follow-up survey was conducted in January 2009. As shown in Table 4, the *communication* among RGs, especially between young and older RGs, has significantly improved over time. In terms of *time management* (Table 5), no significant changes could be identified.

The evaluation of the *workplace conditions* (Table 6) revealed a significant improvement in the team cooperation and in the qualification opportunities between baseline and follow-up. These effects remain stable upon adjustment for gender as a covariate (a higher percentage of male RGs participated in the follow-up assessment).

Significant changes over time regarding the *workplace-related scales* 'effort' and 'reward', their quotient 'Effort–Reward Imbalance' (ERI), e.g. 'I do not get the expected reward for the effort I have made', or the scale of 'occupational overcommitment' were not found.

Table 3 Structural interventions to improve time management

Time management	Structural measures
Interaction within the RG team	> Reinforcement of weekend staffing with an additional shift > Adjustment of the time frames in the mammography programme (more time/patient, buffer zones) > Delegation of tasks to administrative personnel, additionally employed medical assistants
Inconsistencies at management level (upper and middle management)	> Early RG staff roster planning (at least 4 weeks in advance)

Table 4 Results in the area of communication

Item ^a	T1 (<i>n</i> = 21) <i>n</i> (%)	T2 (<i>n</i> = 23) <i>n</i> (%)	<i>p</i>
1 Between RGs and patients	19 (91)	23 (100)	NA
2 Among RGs	9 (43)	22 (96)	<0.001
3 Between young and older RGs	11 (52)	19 (83)	0.02
4 Between RGs and radiologists	19 (91)	22 (96)	0.465
5 RGs with administrative collaborators	20 (95)	23 (100)	NA
6 RGs with nurses of other hospital departments	13 (62)	19 (83)	0.12
7 RGs with physicians of other hospital departments	17 (81)	19 (83)	0.47
8 RGs with physicians from outside	16 (76)	19 (83)	0.31

Data are presented as counts and percentages for rating “(very) good”

RGs radiographers, NA not applicable

^aItem numbers are defined in the [Instruments](#) section

Bold print indicates statistically significant difference between T1 and T2

Discussion

There are several reasons for the current shortage of well-qualified personnel in the health care system in general and of radiographers in particular. Fewer young adults decide to go into health care professions because of the demand imposed on their lives physically and psychologically. There is an increased demand for well-qualified personnel not only because of the aging population requiring more health care, but also because of a massive rise in demand for radiological services to expedite the diagnostic process. With high technology costs and an increased complexity of the equipment, the technology is sometimes changing faster than current training programs can be provided. At the same time, increased requirements (health services restructuring, increasing consumer orientation, increased regulations and demand for continuous quality improvement and learning) result in an increased individual workload for the staff of radiology departments [3, 4, 6].

Facing these challenges, the concept of providing a motivating workplace experience to assure employee satisfaction, motivation and retention—and thus also productivity—becomes very important for the heads of departments as well as health care administrators [4]

Compared with the considerable amount of research on job satisfaction and organisational commitment, a Medline search resulted in only very few articles related to the specific situation of RGs [1–3, 13–15].

Within the framework of organisational development and quality management at our ISO 9001:2000-certified institute with a long-term commitment to continuous improvement, we therefore decided to conduct the study presented in order to implement structural and interpersonal measures to further improve the workplace environment for our RG team.

There are some limitations to our study. We had intended to conduct a longitudinal study. For medical technologists, being young and mainly female and with a variety of open job opportunities being available, a relatively high turnover is normal [2]. There was indeed a high employee turnover in our RG team during the study period. In addition, some RGs, who were employed at both time points, answered the questionnaire at one time point only, either T1 or T2. Only nine RGs (six women and three men) participated in both assessments. Furthermore, based on the size of our radiology department, from a statistical point of view, the study population was relatively small to begin with.

Table 5 Results in the area of time management

Item ^a	T1 (<i>n</i> =21) <i>n</i> (%)	T2 (<i>n</i> =23) <i>n</i> (%)	<i>p</i>
1 Time pressure in emergency examinations	16 (76)	21 (91)	0.17
2 Conflict between high demand and RGs' time resources	16 (76)	15 (65)	0.23
3 Possibilities for independent organisation of free examination slots	14 (76)	13 (57)	0.34
4 Concordance between time scheduling of ambulant patients and time resources of RGs	9 (43)	13 (57)	0.33

Data are presented as counts and percentages for rating “(very) high/good”

RGs radiographers

^aItem numbers are defined in the [Instruments](#) section

Table 6 Results for workplace conditions, effort–reward imbalance, and overcommitment

Scale	T1 Mean (SD) <i>n</i> =21	T2 Mean (SD) <i>n</i> =23	T1 Adjusted mean	T2 Adjusted mean	<i>p</i> (for adjusted mean difference)
Job decision latitude	2.95 (0.84)	2.97 (1.00)	2.95	2.97	0.94
Stress	3.25 (0.77)	3.30 (0.89)	3.29	3.27	0.93
Team cooperation	3.05 (1.04)	3.83 (0.83)	3.07	3.80	0.02
Qualification opportunities	3.65 (0.77)	4.16 (0.75)	3.65	4.16	0.03
Leadership	3.19 (0.83)	3.61 (0.98)	3.21	3.59	0.18
Effort	11.90 (2.83)	14.09 (4.59)	12.44	13.62	0.25
Reward	46.24 (8.81)	45.22 (8.42)	47.16	45.55	0.50
Effort–Reward Imbalance	0.57 (0.20)	0.72 (0.32)	0.60	0.70	0.23
Overcommitment	2.11 (0.56)	2.02 (0.43)	2.13	1.98	0.31

Data are presented as means (SD), and as gender-adjusted means and results of analysis of covariance (with gender as covariate)
 Bold print indicates statistically significant difference between T1 and T2

Therefore, the results are based on two independent samples, and the survey does not represent the longitudinal study we had wished for. This makes it difficult to distinguish the effect of intervention from a sampling effect. It could be postulated that at least part of the improvement in communication might rather be attributed to a change in personnel than to the success of the interventions. The impact of those interventions is, however, supported by the fact that the results were mainly improved in those areas where interventions were performed, i.e. communication, but remained fairly constant in other areas, e.g. job decision latitude.

Our study has several strengths. All interventions were planned together with the RG team based on interviews with focus groups. We combined structural and interpersonal interventions, which then were implemented step by step.

Some structural measures, such as the implementation of regular team meetings, could be introduced at the very beginning of the intervention period; these tools proved to immediately greatly improve the communication culture within the RG team.

We were, however, aware of the fact that meetings need time, a precious resource especially since time management was a big concern in the study. Therefore, there was a certain risk that time pressure might even increase further as a result of this intervention. We were able to accommodate time slots for these meetings at the beginning or the end of working shifts or immediately after the lunch break. The potential problem of further increasing time pressure by this intervention was also addressed in the team discussions. The team felt that the benefits outbalance this potential drawback.

The interpersonal interventions, mainly the coaching processes to develop leadership skills in RG team leaders, became effective only in the long run. Coaching sessions for leadership and management skills were provided not

only for the RG team leaders, but also for the chief RG, the radiologists and the head of department. Coaching initiates learning and developmental processes; the effect of these measures can only be seen after several months.

The immediate superiors of the RGs, the team leaders, play an integral role in employee satisfaction. Newly promoted team leaders need to acquire new skills such as evaluating, counselling and inspiring people in order to succeed as a manager [4]. To assist them in achieving this task, individual and group coaching played an important role in middle management, i.e. the level of the team leaders.

We realised, however, that these efforts could only be successful if we have a common organisational vision at the upper level of management consisting of senior radiologists and the chief radiographer (physician and non-physician management together) with responsibilities and goals being clarified and determined. We therefore implemented various measures like regular meetings and leadership coaching at this level too.

The results of our study show that the communication within the team of RGs could be significantly improved during the study period. Interventions that were most helpful in achieving this goal included the daily morning meeting of the entire team with the handover of the night shift, improved information dissemination within the team during the weekly meeting with involvement in decision-making processes, the implementation of an open culture of discussion as well as various social activities.

Although some structural measures like reinforcement of weekend staffing with an additional shift were implemented, no significant changes were observed with regard to time management during the study period. During our study period, the diagnostic workload has further increased between T1 and T2 (e.g. +11% for mammography, +9% for MRI), whereas the total number of staff members remained

constant. It could therefore be postulated that the interventional effect was compensated for by higher workload and time pressure. The fact that despite the higher work load the potential for conflict did not increase might even be explained by better team cooperation.

The observed improvement in qualification opportunities is likely a result of the coaching process of the team leaders/superiors as well as the efforts to encourage internal and external opportunities for further training.

On the scales 'job decision latitude' and 'stress' there were no changes. These are, however, external factors that can hardly be influenced by such interventions.

Leadership at the upper management level was improved, but has not yet reached the level of significance, most likely because of a time delay, as this was the last of the coaching processes to be initiated.

The interventional effect on the ratio of effort and reward is probably influenced by the different gender distribution at T1 (men, $n=3$) vs. T2 (men, $n=6$). As described in the literature, male employees generally present with a higher imbalance compared with their female co-workers, as they expect more reward from their superiors for the effort they expend in the workplace [12].

Conclusion

Good communication is an important factor influencing the working atmosphere in a team of radiographers. The interventions implemented in this study proved to be suitable for improving internal communication within the group. The personal experience of the management team with regard to the improvement in communication skills and culture of discussion coincides with the quantitative measurements.

The entire process was believed to be very helpful in providing a motivating workplace experience for the radiographers at our institute. We consider these conditions to be an important factor for attracting well-qualified radiographers to work at our institute and to stay in the team for a longer period. We hope that the results of this study will help radiology managers to better understand the factors that contribute to a good working atmosphere in their department.

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