Verification of operational database for MRI and evaluation analysis on tasks for safety management

Osaka International Cancer Institute

Minoru KAWAMATA, Akira MASAOKA, Souichiro TATEISHI,

Yasuhiko YAMANE, Akitoshi YONEDA, Katsuyuki NAKANISHI

Background & Purpose

- The environment surrounding medical care is constantly changing.
- While MRI imaging continues to innovate rapidly (with various applications being researched and developed) as the magnetic field of devices increase, there are very few examples that systematically evaluate the safety of the examination.
- If we do not evaluate, we may lose sight of the nature of our work.

    - In this research, the tasks of MRI examination are systematized and classified according to the evaluation items.
    - We investigate which components are important in the safety management.

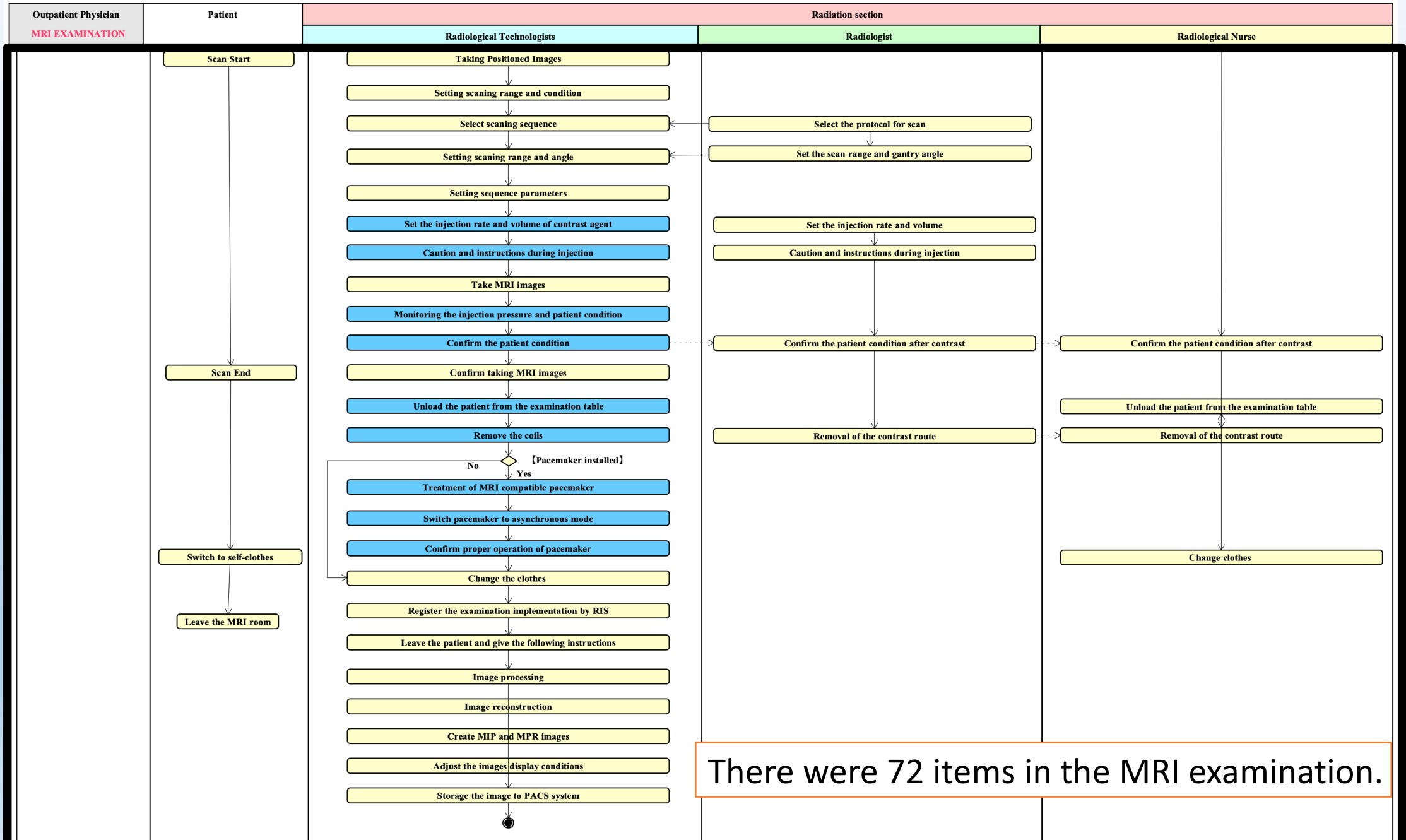
Methods

- We examine the important tasks in MRI Examination by the following methods.

1. Drawing Activity Diagram using **UML (Unified Modeling Language)**

   software : JUDE Professional 6.7 (Change Vision Co., Ltd., Japan)
2. Creating evaluation items using **brainstorming** and assigning evaluation items to the tasks from Activity Diagram.
3. Performing **ISM (Interpretive Structural Modeling) analyses** on the components related to medical safety and evaluating the relevance and impact of each of the components

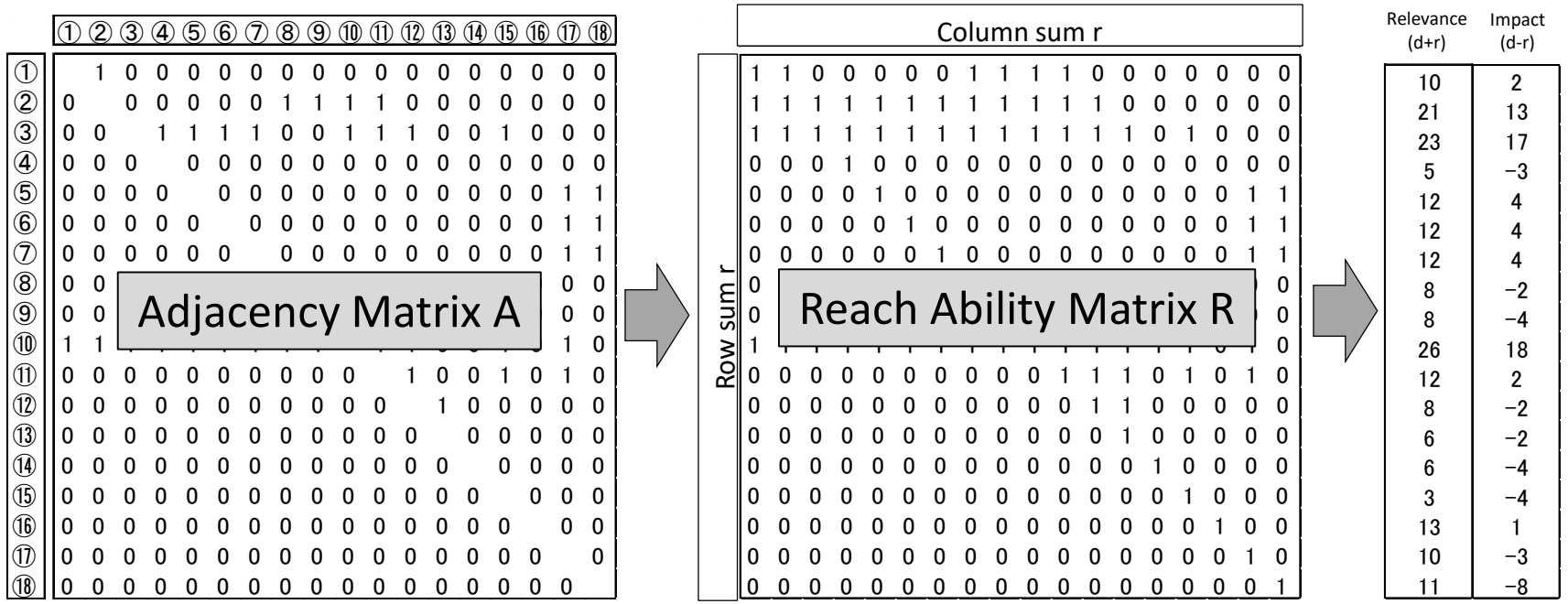
Result1. Activity Diagram for MRI Examination by UML



There were 72 items in the MRI examination.

We extracted 43 components from 72 items related to safety management by brainstorming, and performed ISM analysis on them.

ISM (Interpretive Structural Modeling) analysis



	Relevance (d+r)	Impact (d-r)
①	10	2
②	21	13
③	23	17
④	5	−3
⑤	12	4
⑥	12	4
⑦	12	4
⑧	8	−2
⑨	8	−4
⑩	26	18
⑪	12	2
⑫	8	−2
⑬	6	−2
⑭	6	−4
⑮	3	−4
⑯	13	1
⑰	10	−3
⑱	11	−8

$$R = \sum_{k=1}^{m} A^k + I, \quad A^m = O$$

Relevance : The sum of the impact on other tasks and the impact from other tasks.
If this value is large, there is a high mutual relevance with other tasks.

Impact : Deducting the influence from other tasks than the influence on other tasks.
If this value is large, it easily influences tasks, and if it is small, it is easily affected.

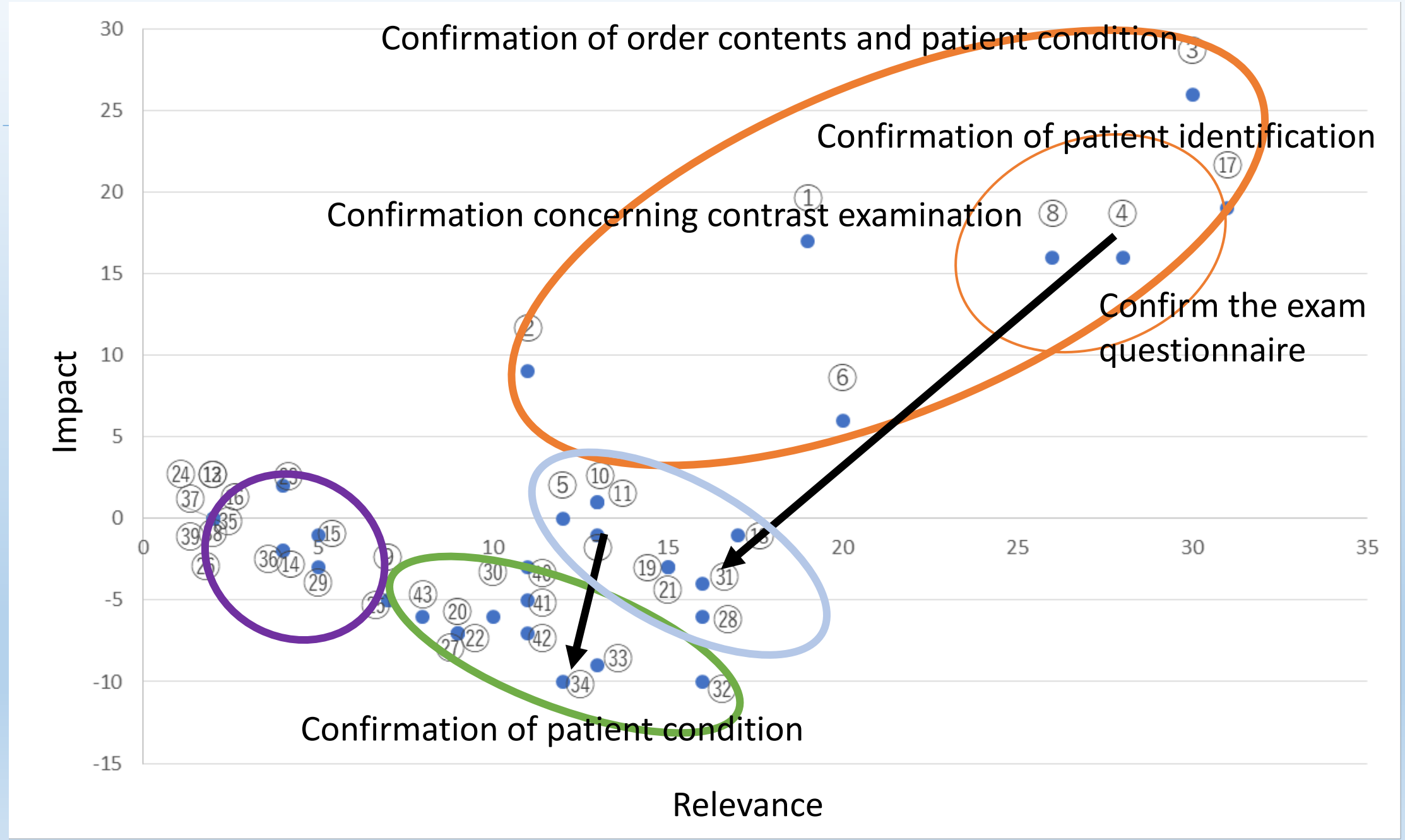
Result2. Analysis result by ISM method (safety management)

No	Business related to safety management	Relevance	Impact
①	Select the examination displayed on the RIS	19	17
②	Pass the exam questionnaire to the patient	11	9
③	**Confirmation of order contents and patient condition**	**30**	**26**
④	**Confirm the exam questionnaire**	**28**	**16**
⑤	Confirmation of patient's weight	12	0
⑥	Confirm existence of pacemaker and defibrillator	20	6
⑦	Confirmation of surgical history and metals implanted in the body of patients	13	-1
⑧	**Confirmation concerning contrast examination**	**26**	**16**
⑨	Confirmation of consent form	7	-5
⑩	Confirmation of side effect history of contrast agent and allergy	13	1
⑪	Confirmation of kidney function	13	1
⑫	Confirmation of previous scanning sequence	2	0
⑬	Confirmation of previous request contents from doctor	2	0
⑭	Preparation for the examination	4	-2
⑮	Preparation of auxiliary tools and fixtures	5	-1
⑯	Invite patient to rest room	2	0
⑰	**Confirmation of patient identification**	**31**	**19**
⑱	Explanation and agreement about the examination	17	-1
⑲	Treatment of MRI compatible pacemaker	15	-3
⑳	Switch pacemaker to asynchronous mode	9	-7
㉑	Confirm proper operation of pacemaker	15	-3

Result2. Analysis result by ISM method (safety management)

No	Business related to safety management	Relevance	Impact
㉒	Preparation for contrast injection	9	-7
㉓	Confirmation of the contrast route	4	2
㉔	Injection of the contrast route	2	0
㉕	Invite a patient to the examination room	7	-5
㉖	Put the patient on the examination table	2	0
㉗	Explanation of examination procedures and instructions	9	-7
㉘	Selection of contrast agent	16	-6
㉙	Connecting injector and route	5	-3
㉚	Confirmation of Leakage of Contrast Agent	10	-6
㉛	Set injection rate and injection volume	16	-4
㉜	Caution and instructions during injection	16	-10
㉝	Monitor injection pressure and patient condition	13	-9
㉞	Confirmation of patient condition	12	-10
㉟	Put out a patient from a gantry	2	0
㊱	Remove the coils	4	-2
㊲	Dismantle the patient from the examination table	2	0
㊳	Move patient to rest room	2	0
㊴	Removal of contrast route	2	0
㊵	Treatment of MRI compatible pacemaker	11	-3
㊶	Switch pacemaker to asynchronous mode	11	-5
㊷	Confirm proper operation of pacemaker	11	-7
㊸	Leave the patient and give the following instructions	8	-6

Result3. Directed graph（MRI）



Results

1. In the Activity Diagram, there were 72 items in the MRI examination.
2. As a result of brainstorming, the work of MRI examination could be classified into quality control, **safety management** and image management. There were 43 components classified as safety management.
3. In the MRI exam, the components related to safety management were "confirmation of **patient identification**", " confirm **the exam questionnaire**", "confirmation concerning **the contrast examination**”, "confirmation of **the order contents and patient condition**" and these components were affecting other work.

Conclusion

- Awareness of radiographers for safety in our hospital has increased by identifying work components related to medical safety and clarifying the degree of influence of the items in the work flow.
- Even if the medical environment changes, we will not lose sight of the nature of our work in MRI examination.