＜Original Article＞

The study on the visualization of utilization behaviors in health care in Africa by Unified Modeling Language

Maya IWASA[1]，Yuko OHNO[2]，Sachiko SHIMIZU[3]

Abstract

Background: In recent years, the role of medical support for developing countries has been reviewed, and there is an urgent need to set up a health care system based on current utilization behaviors in health care.

Objective: This study aimed to clarify healthcare workers'utilization behaviors in health care and consultation processes with modern and traditional medicines in African countries with Unified Modeling Language（UML）.

Methods: This study, conducted with interviews and questionnaires on eleven healthcare workers from five African countries, examined their medical consultations for their diseases during the past year. With this data, their consulting processes were analyzed with UML: from their disease perceptions to consultations at medical institutions.

Results: It was revealed that healthcare workers'consultations are modern-medicine-centric, taking place at hospitals-mainly health centers-and traditional medicine providers（herbalists）.

Conclusion: While health care systems vary from country to country, the UML succeeds in showing consultation behaviors models. This method can also be utilized to recognize current problems. With this method, not only local healthcare workers but also supporters can recognize these universal utilization behaviors in health care and problems.

Keywords：utilization behaviors in health care, Unified Modeling Language, Africa, visualization, healthcare workers

Ⅰ　Introduction

While the role of medical support for developing countries is being reviewed, a way to provide for sustainable support has to be developed immediately[1-2]. This requires the establishment of a health care system that incorporates not only modern medicine but also local traditional medicine[3-6].There have been a few reports on utilization behaviors in health care with both kinds of medicine with a focus on rural residents in Asia and Africa[7-9]. However, no report has been made on that of healthcare workers or urban residents in rapidly modernizing countries.

While support on the basis of differences in medical environment among countries is needed, many of these countries are multiethnic and multilingual and it is also necessary to establish the support methodology with visual information, which allows us to investigate their uniqueness[10-11]without trying to standardize utilization behaviors in health care.

In recent years, practical applications of visualizing information with UML（Unified Modeling Language）have been reported as it can respond flexibly to medical business models[12-14]. Therefore, making use of UML, this study aimed to clarify healthcare workers' utilization behaviors in health care and consultation processes with modern and traditional medicines in African countries.

1　Maya IWASA　　　　Faculty of Nursing, Senri Kinran University
2　Yuko OHNO　　　　Dept. of Mathematical Health Science, Osaka University Graduate School of Medicine
3　Sachiko SHIMIZU　　Dept. of Mathematical Health Science, Osaka University Graduate School of Medicine

Ⅱ　Methods

Subjects：We extracted subjects from the training list of JICA（Japan International Cooperation Agency）in the 2008 fiscal year. Subjects were premised on being healthcare workers who are working at the medical front and know well about patient's views. We selected one training group in consideration of a training participant's parent organization, position, and activity area. This training aimed at the capacity building in regional healthcare. Finally, subjects were 11 healthcare workers from five African Francophone countries who came to Japan in the 2008 to participate in JICA training and made up of consenting to cooperate in the study.

Investigating Method：It was implemented in two steps. In the primary survey, a descriptive questionnaire in French was used. The survey covered illnesses that the subjects had experienced in the past year.

The secondary survey was conducted by interviewing each subject about consultation processes. The data were analyzed qualitatively and inductively. The data obtained from the two-step survey were classified in three steps to organize and summarize the subjects'consultation processes: １）by disease of each subject, ２）disease by healthcare worker of each country, and ３）by institution regardless of country or disease. The results, then, were visualized with UML in the Activity Diagram.

The subjects'countries were uniform colonies of France, so their medical systems were highly similar[15-17]. Therefore, in consideration of the functions and healthcare workers of institutions, we divided the medical institution roughly into the dispensary, the health post health center, the general hospital, and the university hospital.

The survey took place from June to July, 2008.

Ethical Considerations：This survey was conducted in conformity with Declaration of Helsinki. All participants were provided written and oral guarantee that they could discontinue their participation at their own will, that either participation or refusal would not affect the training being received, and that they could refuse to answer any questions with impunity. Moreover, we explained that the existence of research partnership is completely unrelated to continuation of training.

Ⅲ　Results

Subjects：The subjects were 11 healthcare workers including 2 from Senegal, 2 from Burkina Faso, 2 from Benin, 2 from Madagascar, and 3 from Niger. Of the11subjects, 5 were men and 6 women; they included 2 doctors, 3 nurses, a senior public health nurse, a senior medical technician, a school superintendent（school health）, an epidemiologist, a midwife, and a social worker.

6 subjects lived in urban areas and 4 in rural areas; all of the rural dwellers resided in populated areas, not in agricultural areas. All their residences were located within 2 kilometers from modern medical institutions. Nine out of the 11 lived in villages with either traditional medical centers or traditional medical practitioners.

Types of diseases and the visited medical institutions：
The number of incidences of sickness for all subjects over the previous year was 16 incidences. These ranged from one to four incidences per person. 56%（n=9）of the diseases were infections.

Of the treatment that the subjects first received, 93%（n=15）was modern medicine, 40%（n=6）of which was at hospitals , 47%（n=7）at health centers, and leaving 13%（n=2）at other institutions.

Only one subject chose a traditional medicine provider（herbalist）for the first consultation. When he became affected with dysentery, he was visited by an herbalist and received decoction made from natural materials such as plants and animals.

As a second resort, not having recovered fully, one received modern medicine（at a health center）, and one traditional medicine（from an herbalist）. The former visited a modern medical provider after having first received traditional medicine and

been given decoction to alleviate his symptoms and improve ambulatory functions. The latter first visited a modern medical provider to take a blood test, which revealed that he had a liver disease caused by a virus. Since the modern medicine had not brought him sufficient relief, he received herbal treatment as a second resort at his own decision.

Consultation processes in activity diagram：
Consultation processes, from the first consultation to full recovery, were classified by medical provider in three Activity Diagrams: Hospital（including university hospitals）（Figure 1）, Health Center （Figure 2）, Traditional Medicine Provider （herbalist）（Figure 3）.
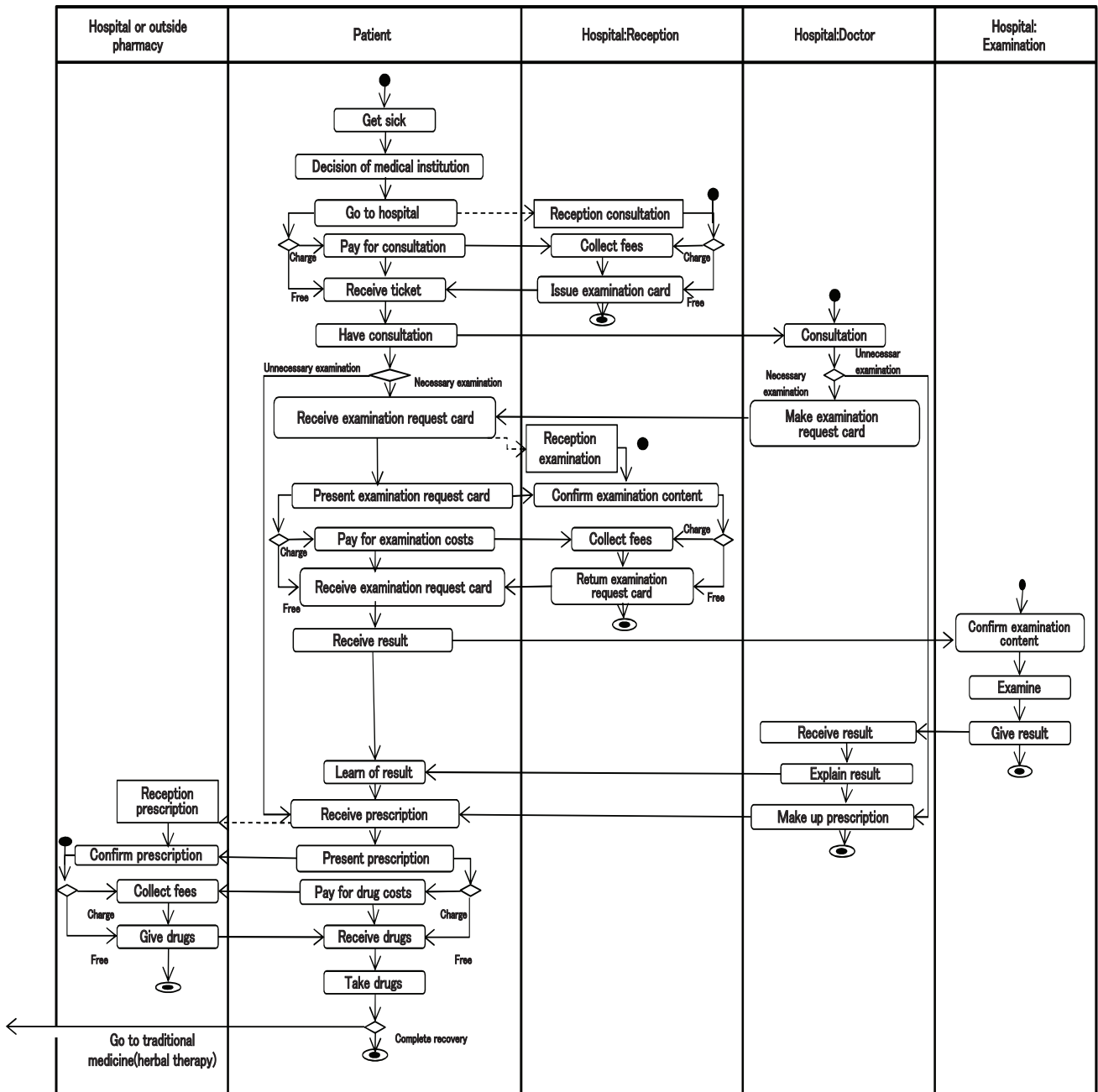

Figure 1 . Activity diagram of hospital
This figure is an activity diagram of UML which collected five persons'（six diseases）actual consultation process which made hospital（including university hospitals）selection in the first or second consultation institution.
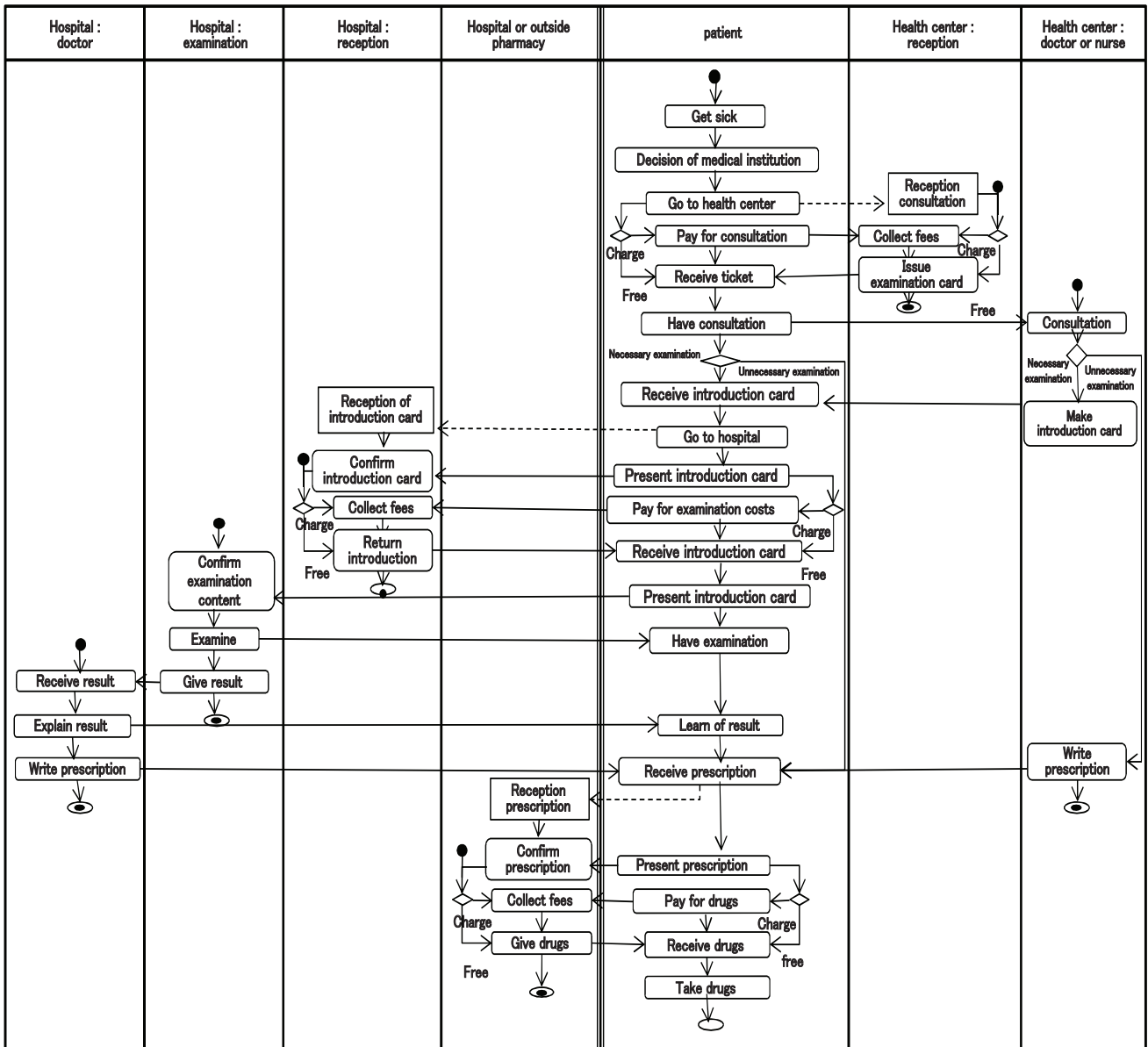
Figure 2. Activity diagram of health center

This figure is an activity diagram of UML which collected five persons'（eight diseases）actual consultation process which made health center selection in the first or second consultation institution.

At hospitals, patients paid a basic consultation fee at the reception desk, were diagnosed by their doctor, received an examination request, and presented it to a receptionist and an examiner. Patients next underwent an examination and received explanations from their doctor, got a prescription, and bought medicine at either an on-site or an outside pharmacy.

At health centers, consulting processes followed two patterns. 1）Patients took a prescription to an on-site or outside pharmacy and bought medicine after doctors or nurses diagnosed and prescribed.

2）After paying a basic consultation fee at the reception desk and having a referral written by a physician at the health center, a patient took it to a nearby hospital to have an examination and seek a diagnosis; then she/he bought prescription drugs at an on-site or outside pharmacy.

Traditional medicine providers offered treatment at patients' homes or medical institutions （herbalists' homes）where herbalists chose herbs and created herbal formulas depending on the symptoms reported by patients, for which a cash payment was made.
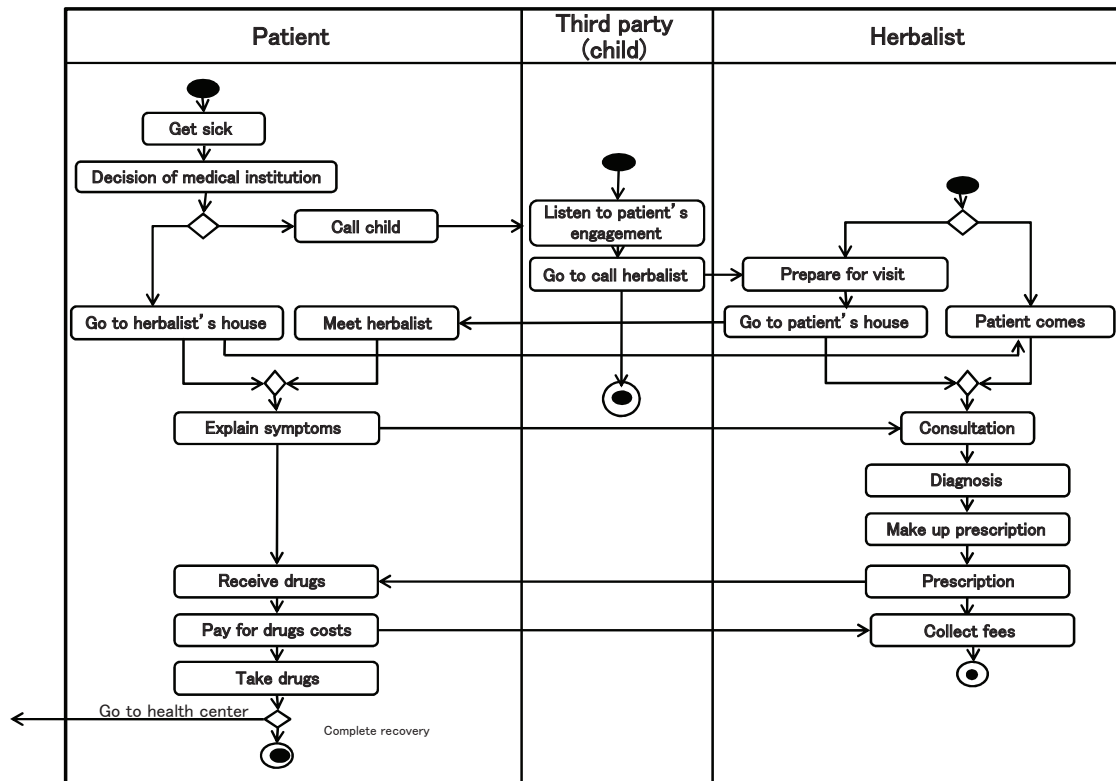
Figure 3. Activity diagram of traditional medicine（herbalist）
This figure is an activity diagram of UML which collected two persons'（two diseases）actual consultation process which made herbalist center selection in the first or second consultation institution.

Ⅳ　Discussion

Modern-medicine-centric consultation process:
Consultation patterns of healthcare workers are centered on the modern medical system such as hospitals. While traditional medicine was used for certain diseases, evidence-based modern medicine was used in conjunction with it. Two main interactive factors leading to this modern medicine-oriented consultation pattern can be identified.

The first factor is related to the strong sense of professionalism of healthcare workers. Having been educated to look at matters reasonably and scientifically in the course of their career[18-23], they recognized the importance of objective diagnosis and assessment of treatment effect. Their great respect for modern medicine and their professionalism led them to choose modern medicine for their own illnesses. Conversely, as these values kept them from receiving traditional medicine, they did not always reject it but rather did not choose it for their own illnesses.

The second factor is healthcare workers' pursuit of more advanced medical treatment. The subjects who did not work in university hospitals received treatment at their workplace or upper level institutions. They never visited health care institutions of a lower level than their own. They expected to receive treatment at the same level as or higher than the treatment they themselves offered and to enjoy more reliable and safer medical care.

Analysis with Activity Diagram: Most consultation forms and processes were successfully visualized in a single activity diagram with UML. UML, whose original purpose is to model business systems[24], is not intended to standardize consultation processes by adding individual utilization behaviors in health care, this visualization shows that health care professionals take almost the same health actions irrespective of living in different countries.

Comprehensive perspective: We just take a developing country how much have received economical support, in order to consider health and medical support from actual utilization behaviors in health care . The national budget in 2005 of Senegal which is one of the countries of subjects（include aid）was 1,256（millions US $）, and 8.1% of them was the health and medical fields. In those fields, 26 international assistance agencies were supporting. 63.2（millions US $）of the national budget in 2005 were provided by aid money[25]. Construction of institutions and human resource development were included in support. When building institutions in a developing country, it is important to make the flow line of patients and healthcare workers coexist naturally according to the diagnostic of the country rather than to build the miniature version of the Western medical institutions in developing countries.

We consider that visualized information which can see systematically procedure and disposal becomes key perspectives when maintainable medical treatment is offered. An activity diagram is utilizable as visualization data to make a decision how and where to arrange is required. This can provide the basis of discussion when effective staffing and work sharing are to be considered in developing countries with few professionals but with a lot of patients.

Furthermore, if providers of assistance and recipients of assistance can share actual conditions and future tasks using visualized information, more realistic and better health and medical service will be developed. Meanwhile, as this study shows that the subjects did not visit primary-level clinics that many ordinary citizens usually visit, it has not yet managed to reveal the difference of utilization behaviors in health care between general public and healthcare workers. What is needed in the future is an analysis of such differences not only in the regions and tribal groups of the various countries but also within a single country. This may make it possible to determine the shape of a comprehensive support strategy for planning a health care system into which both modern and traditional medicines are incorporated.

Ⅴ　Conclusion

This study revealed that healthcare workers took much the same utilization behaviors in health care regardless of their religion or the economic system of their country. Not only local healthcare workers but assistance providers can utilize the visualization of utilization behaviors in health care to standardize our understanding of the present situation and its challenges.

Ⅵ　References

1 ） WHO, *African Advisory Committee For Health Research and Development*, 18-21, Regional Office Brazzaville,（2002）

2 ） WHO, *Traditional Medicine Strategy 2002-2005*, 7-10, WHO,（2002）

3 ） Otake H, African tradition medical care and the medical assistance to the alternative medicine, *A science of nursing synthesis research*, 6, 50-52（2004）

4 ） WHO, *Guidelines for Training Traditional Health Practitioners in Primary Health Care*, WHO Division of Strengthening of Health Services and the Traditional Medicine Programme. 5-11, WHO,（1995）

5 ） The director general of WHO and the executive director of UNICEF, *Primary health care*, 44-52, WHO/UNICEF,（1978）

6 ） WHO, *The Promotion and Development of Traditional Medicine*, WHO Technical report Series 622, 1-2, WHO,（1978）

7 ） Wessel H. ,Reitmaier P., Dupret A., et al., Health-Seeking Patterns among Fatally Ⅲ Capeverdian Women, *African Journal of Reproductive Health*, 8, 176-187（2004）

8 ） Shimobiraki C. and Jimba M, Traditional vs. Modern Medicine: Which Healthcare Opinions Do the Rural Nepalese Seek?, *Technology and Development*, 15, 47-54（2002）

9 ） Subedi J, Health services and health care behavior: A survey in Kathmandu Nepal, *journal of health and social behavior*, 30, 412-420（1989）

10）Becker C.and Collignon R, Epidemics and colonial medicine in West Africa, *Santé*, 8, 411-416 （1998）（in French）

11）Fassin D. and Fassin E, Traditional medicine and the stakes of legitimation in Senegal, *Social Science & Medicine*, 27, 353-357（1998）

12）Kumarapeli P., DeLusignan S., Ellis T. et al., Using Unified Modeling Language （UML） as a process-modeling technique for clinical-research process improvement, *Medical Informatics and the Internet in Medicine*, 32, 51-64（2007）

13）Saboor S., Ammenswerth E., Wurz M., et al., Med Flow-Improving modeling and assessment of clinical processes, *Studies in Health Technology and Informatics*, 116, 521-526（2005）

14）Knape T., Hederman L., Wade VP., et al., A UML approach to process modeling of clinical practice guidelines for enactment, *Studies in Health Technology and Informatics*, 95, 635-640（2003）

15）Ogawa Ryou, Kanouseitoshiteno Kokkashi-Gendai Africakokkano Hito to Shuukyou-, 28-41, *SekaishisoSha*,（1998）（in Japanese）

16）Charles B., René C, Épidémies et Médecine coloniale en Afrique de l'Ouest, *Cahiers santé*, 8, 411-416（1998）（in French）

17）République du Sénégal, *Plan National de développement sanitaire et social 1998-2007*, 11-28, Ministère de la santé Publique et de l'Action Socialè-République du Sénégal,（1997）（in French）

18）Université Cheikh Anta Diop de Dakar, *Statistiques Année universitaire 2000-2001 Faculté de Médecine de Pharmacie et d'Odontologie*, 10-40, Université Cheikh Anta Diop de Dakar,（2000）（in French）

19）République du Sénégal, *Centre de Formation Professionnelle et Technique*, 25-40, Ministère de L'éducation National,（2000）（in French）

20）Plager K. and Razaonandrianina J, Madagascar nursing needs assessment; education and development of the profession, *International Council of Nurses*, 58-64（2009）

21）Le Système d'éducation au Bénin （2010）, Le Ministre de l'Enseignement Supérieur et de la Recherche Scientifique （http://www. mesrs.bj/ spip.php?article20&var_recherche=education%20 infirmiere）, May. 27（in French）

22）Niger-santé（2010）,Ministère de la Santé Publique （http://www.gouv-niger.ne/index. php?option=com_content&task=view&id= 83&Itemid=110）, May. 27（in French）

23）Country profiles Burkina Faso （2010）, The Center for International Higher Education （http:// www.bc.edu/bc_org/avp/ soe/cihe/inhea/profiles/ Burkina_Faso.htm#cite）, May. 27（in French）

24）James R., Lvar J. and Grady B, *The Unified Modeling Language Reference Manual 2nd ed*, 12-54, Addison-Wesley Professional Addison,（2004）

25）la Banque Mondiale, *Sénégal Développements Récents et les Sources de Financement du Budget de l'Etat-Revue des Dépenses Publiques Rapport*, No. 36497-SN, la Banque Mondiale,（2006）（in French）

＜原著論文＞

Unified Modeling Language手法を用いたアフリカ諸国における受療行動の検討

岩佐　真也，大野　ゆう子，清水　佐知子

要　旨

目的：近年、発展途上国に対する医療支援のあり方が見直され、現在の受療行動を基盤とした保健医療システムの設計が急務となっている。日本の発展途上国に対する保健医療分野の支援は、ODA予算の削減に伴い減少しており、対象国に合った支援をより効果的に実践することが求められている。そのためには、可視化情報に基づく分析方法の確立が必要であり、その一つとしてUnified Modeling Language（UML）が注目を浴びている。そこで本研究は、UMLを用いて過去一年間に罹患した病気の受療行動を可視化し、効果的な保健医療支援の可能性を検討する事を目的とした。

方法：来日したアフリカ５カ国の保健医療関係者計11名を対象とし、過去一年間に罹った病気の対処行動を質問紙調査と面接調査により把握した。把握した情報を基に病気の知覚から医療機関（伝統医療を含む）受診のプロセスを３段階に分け整理した。まず、個々の対象者の罹患疾患ごとに、次に個々の対象者の罹患疾患を各国の受診機関ごとに、最後に国と疾患を越え受診機関ごとに整理し、集約した。その後これらの結果をUMLのアクティビティ図を用いて可視化表現した。

結果：保健医療関係者の受療形態は、病院をはじめとする現代医療中心の形態を成しており、対象国により保健医療システムに違いはあるが、保健センター、病院、伝統医療（薬草師）に大別することができた。また、UMLを用い対象者各々の受診のプロセスをアクティビティ図に集約することで、アフリカ５カ国の現代医療と伝統医療の受療形態と受診プロセスをほぼ可視化することができた。さらに、民族や宗教は異なっても保健医療関係者であれば、ほぼ同様の受療行動であることが明らかになった。

考察：UMLを用いて受療行動の詳細を可視化することにより、現地の保健医療関係者だけでなく、支援する側にとっても現状や課題が見えやすくなった。特に、保健医療支援内容で重要な施設建設や人材育成については可視化情報を用いることで、課題認識の共通化が図れ、より実践的で効果的な対策が考えられることが示唆された。

キーワード：受療行動，ＵＭＬ，アフリカ，可視化，保健医療関係者