討した上で、その結果を可能な限り途上国に提案できる具体的な保健医療指針として、日本の保健医療政策の課題から学べることも含めてまとめる予定である。

引用文献

1. 厚生統計協会. 国民衛生の動向. 東京：厚生統計協会, 2003.
2. 厚生労働省大臣官房統計情報部. 平成13年母体保護統計報告. 東京：厚生統計協会, 2002.
3. 厚生労働省雇用均等・児童家庭局. 平成12年度児童相談所における児童虐待相談処理報告数. 2002年10月　http://www.mhlw.go.jp/houdou/h1114-3.html
4. 中村安秀. 農村における公衆衛生の推進：母子保健を鍵にして途上国への応用可能性を考える. 国際開発研究　11：67-80, 2002.
5. Goto A, Reich MR, Aitken I. Oral contraceptives and women's health in Japan. Journal of the American Medical Association 282: 2173-2177, 1999.
6. Goto A, Fujiyama-Koriyama C, Fukao A, Reich MR. Abortion trends in Japan, 1975-95. Studies in Family Planning 31: 301-308, 2000.
7. Cash R, Matsuyama A. Changes in child and maternal mortality patterns in Japan from 1915-1965 and probable contributing factors. (Discussion paper) 1990, Tokyo.
8. 多田羅浩三. 新しい地域保健サービス. 東京：ぎょうせい, 1998.
9. 小西正光, 小野ツルコ.「健康日本21」を指標とした健康調査と保健支援活動. 横浜：ライフ・サイエンス・センター, 2001.

（注：本文中カッコ書きの文献は文献リスト参照）

表1. 日本の母子保健医療の経過および今後の課題に関する文献の検索結果

検索方法・検索日	抽出数	入力該当数
Japan AND (Family planning OR Contraception OR Abortion) 検索日：2004年2月2日	86	14
Japan AND (Population OR Birth rate) 検索日：2004年3月16日	174	4
Japan AND (Maternal mortality OR Infant mortality) 検索日：2004年2月2日	117	29
Japan AND (Child health service OR Maternal health service) 検索日：2004年2月4日	23	9
Japan AND (Community health service OR Primary health care OR Health promotion OR Health education) 検索日：2004年2月4日	179	14
Japan AND (Communicable diseases OR Diarrhea OR Pneumonia OR Tuberculosis OR Immunization OR Vaccination) AND (Public health OR Epidemiology) 検索日：2004年3月15日	59	7
Sawauchi 検索日：2004年3月15日(PubMed使用)	4	2
先行研究(5, 6)で収集した文献	—	26
重複を除いた合計入力数		83

表 2. 抽出文献の研究内容別分類

分野（文献総数）	研究内容	方法	文献番号*	
			MEDLINE	その他
中絶・家族計画（MEDLINE 12、その他 10）	中絶の動向	記述統計	(1), (27)	
	中絶による身体的・精神的影響	症例対照研究	(18), (30)	
	中絶目的受診者・中絶経験者の特徴	横断研究	(29)	(24)
	計画外妊娠経験者の頻度および経験関連要因	横断研究	(25)	
	経口避妊薬認可の歴史経過	論説	(2)	(4), (5), (9), (10)
	人口、家族計画、中絶の動向、経口避妊薬の認可など	論説、横断研究	(12)	(11), (16), (19)
	経口避妊薬使用による計画外妊娠減少の推計	横断研究	(3)	
	経口避妊薬使用希望者・高容量経口避妊薬使用者の特徴	横断研究	(13), (26)	
	経口避妊薬と勃起機能不全治療薬の認可過程の比較検討	論説	(17)	
	経口避妊薬認可と中絶に関する政策の比較検討	論説		(8)
	コンドームが頻用される文化背景	横断研究・質的面接		(6)
出生・人口（MEDLINE 3、その他 3）	出生を規定する要因	横断研究、記述統計、地域相関研究	(57)	(14), (28)
	平均寿命の動向	記述統計	(58)	
	少子化の中で小児科が果たす役割	論説	(56)	
	人口政策の変化	論説		(7)
思春期（MEDLINE 2、その他 2）	思春期の性行動と中絶の動向	論説	(22)	
	10 代産婦人科受診者の特徴	横断研究	(20)	
	10 代の妊娠率に関連する要因	地域相関研究		(15)
	日本と欧米諸国の思春期保健の比較検討	論説		(21)
乳幼児（MEDLINE 24）	乳幼児死亡率の背景要因	論説、記述統計、地域相関研究	(35), (37), (38), (39), (40), (52)	
	母子健康手帳の普及と乳幼児死亡率	記述統計	(36)	
	乳幼児死亡率の動向	記述統計	(41), (42), (43), (44), (45), (48), (54)	

	乳幼児死亡率の地域・人種間格差	記述統計	(46), (47)	
	超未熟児の転帰および死亡率の動向	記述統計	(49), (50), (51)	
	出生体重の動向	記述統計	(53)	
	脳性麻痺の動向	記述統計	(55)	
	新生児・乳幼児スクリーニングのシステム	論説、記述統計	(59), (60), (61)	
妊産婦 (MEDLINE 6、その他 1)	妊産婦死亡の背景要因	記述統計	(31), (32), (33), (34), (39)	
	母子保健向上に果たした母親の役割についての社会文化・歴史的考察	人類学研究		(23)
	母乳推進の成功例	ケースレポート	(75)	
地域保健 (MEDLINE 6、その他 2)	保健師の役割	ケースレポート	(67)	
	日本におけるヘルスプロモーション/プライマリヘルスケア	論説	(69), (70), (74), (76)	
	保健センターの役割	記述統計	(77)	
	岩手県沢内村の保健医療政策	ケースレポート		(62), (63)
感染症 (MEDLINE 6)	結核の疫学	記述統計	(79), (80)	
	百日咳の罹患率と予防接種	記述統計	(81), (82), (83)	
	感染症対策における国立感染症研究所と国立保健医療科学院の役割	論説	(78)	
健康行動 (MEDLINE 7)	学童の運動能力の動向	記述統計	(65)	
	栄養摂取の動向	記述統計	(66), (68), (71), (72)	
	学校給食制度の効果	記述統計	(73)	
	たばこに関するマスメディアの報道とたばこ対策	質的研究	(64)	

*文献リスト参照

表 3. 乳幼児に関する文献で記述されている乳幼児死亡率の関連要因

関連要因		文献番号*
社会	政策	(50), (51), (62), (63)
	地域格差	(46), (52)
	文化背景	(47)
保健	母子保健法による保健事業	(39), (40)
	住民参加	(35), (62), (63)
	母子健康手帳	(35), (36)
	産後ケア	(35)
	家族計画	(35), (40), (41)
	事故防止	(43)
医療	医療技術の進歩	(37), (38), (41), (42), (44), (48), (49), (50), (51), (54), (55)
	医療システム	(35), (40)
	医療へのアクセス	(35), (47)
生物学的要因	性差	(45)
	出産年齢	(35)

*文献リスト参照

資料8

Evidence and Politics
The role of epidemiologists in the verification of pollution in Japan

Emi Inaoka[1], Yasuhide Nakamura[2]

1. Introduction

Japan was the country to experience serious industrial pollution with effects like Minamata disease, which could have been avoided if public policy had been changed. The 1970s can aptly be called Japan's environmental decade, because a citizen's movement created a political force for reform and a lot of new policies were established by central and local governments. Prior to this, health and human rights had not been considered in addition to economic development, and interventions in market mechanisms were considered unnecessary. Thus, there was little incentive to address the pollution problem when it arouse. This was exacerbated by the long time needed to link pollution to newly emerging disease and the difficulties in reconciling changes with stakeholders. Solutions were brought about by various efforts such as advocacy by victims, media reports and verification in the courts.

The role of public health and scientific evidence or of public health specialists including epidemiologists, health administrators and doctors in bringing about change has not been well reviewed. Japan's experience with pollution implies that epidemiologists had difficulties in conducting researches on this and expressing their views, because there are pressures from government and industry, and high quality scientific data to persuade were considered not enough. The government had purposefully used this political power in science to maximize for the country's economic growth. This led to unnecessary delays in finding solutions.

Currently, evidence-based policy making had become the norm, and policy makers are expected to make decisions based on evidence or data. This is the case in health where obtaining evidence has been given increasing attention. But, as the pollution problem in Japan shows, data even when it is of high scientific quality, does not automatically result in the ideal policy unless scientists act in a way that reflects the socially constructed nature of scientific reality and of difference in values and

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conflicts of interest. This article reviews four case studies from the Japanese pollution problem, highlighting the function of epidemiologists in the development of solutions.

2. Overview of pollution problem in Japan

The dark side of Japan's very rapid industrialization and economic growth in the 1960s was severe damage from various forms of environmental pollution. The pollution led to diseases that were inconvenient and embarrassing for both the companies involved and the national leaders who enshrined high economic growth and promoted company's profits in post-war Japan. In response to these new diseases, scientists sought out their causes, companies tried to hide their involvement, victims sought compensation, and the government tried to sweep it all under the table. Collusion and confusion at all levels of government and society, including in the scientific community and the media, allowed the tragedy and its cover-up. This was compounded by powerful pressures against speaking out and taking action. The problem was not solved until social and democratic actions by individuals and the community, moved legal and political institutions, and led the government to formally announce the role contamination in health damage, and to provide payments to victims. Another important response was the creation of the Environment Agency, a unified authority that regulates and advances measures to address pollution and broader environment issues. Because of these changes, as subsequent economic development occurred, which was dependent on a range of chemical substances, Japan took a lead role in efforts to ensure environmental assessment as well as an effective waste management system.

Determining the successes and failures of Japanese environmental policy is no simple matter. There is still no consensus on this or on who is to blame but little attention has been given to the actions and responsibilities of epidemiologists or health specialists despite the vital roles. Epidemiologists are supposed to detect the frequency and distribution of diseases in human populations and identify causal. Doctors are the first actors in identifying diseases with unknown symptoms and detecting the causes of such diseases. Their role is to liaise with health administrators to take action.

In the case of Japan, answers to a number of questions about the pollution problem may help to guide epidemiologists and health specialists in the future. If objective evidence was strategically shown to the legislature and administration, why did evidence-based policy making not happen? What conditions are needed so that evidence can be used for making policy? This article presents four case studies to illustrate the actions of public health professionals in identifying the problem of pollution and its health consequences. This essay does not provide a comprehensive review of Japan's environmental policy; rather it concentrates on the successes and failures of scientists, particularly epidemiologists.

3. Case Study

3-1 Minamata – Epidemiologists' immediate action was prohibited by political pressure

Chisso, a chemical company employing up to 5,000 people on the island of Kyusyu, used mercury as a catalyst in the process of creating plastic products. The mercury was discharged into Minamata Bay and consumed by fish. Residents who ate the fish began getting ill with headaches, loss of sensation, involuntary shaking and immobility in around 1956. In 1959, research data was shown by the epidemiologists to Chisso, but Chisso did not publicly acknowledge its culpability, the company offered sympathy money to the victims for stealthily. It did not remove the mercury before discharging to the water.

In the three years before 1956, 5-8 patients ill with the symptoms of Minamata disease were seen by doctors in the community. In response to these initial cases, Dr. Hosokawa, Director of the company hospital, Chisso Hospital, and other doctors interviewed community members and found more than 30 patients in April 1956. The doctors reported their findings to the Hokenjo, the local public health administration office at the municipality level, and this office brought the report up to the Ministry of Health immediately. In response to this initial report, the municipal government immediately formed a committee of their Doctor's group including Hokenjyo, City council, city hospital and Chisso Hospital to investigate the situation. Provincial office also took also took immediate action and requested local university, Kumamoto University to start investigation. Epidemiologists at Kumamoto University submitted a mid-term report within three months showing that the cause was due to eating fish in the Minamata Bay which was polluted by the Chisso factories. As this shows, doctors, public health officers and epidemiologists acted as they should have, and provided evidence in a formal report within six months of the first formal inquiry.

In 1957, the research team at the University recommended that the Ministry of Health prohibit fishing for the food market, however the Ministry did not take this step with the excuse that no causal relationship had been specified. It is inferred that political pressure was strong so that industry could carry on their operation for attaining economic growth, and the Ministry of Health was unable to generate awareness of the problem against the government view despite the scientists' recommendations. More badly, the Ministry of Health formed a research team to conduct a further survey in July 1957 as an attempt to develop results that would protect the industry by providing data that would conflict with initial theories.

There were limitation on research such as data collections and funds. With the strong support of the government's industrial encouragement policy, Chisso were able to continue denying the results showed contamination without any further research conducted, and prohibit other researches by not allowing data collection from the factory until 1968. Under the solidarity of the economic development policy, research demonstrating the problem of mercury pollution and industry's role in it was regarded as out of the question and was not considered for funding. Other research bodies, such as companies and medical associations shared the interests of the government, and further research was not conducted.

Despites these surroundings, some researchers had strong will to conduct research and proved that Minamata disease was caused by mercury. Dr. Hosokawa and his team continued their research on causality, successfully showing the cause of Minamata disease in 1959. This evidence urged the Ministry to accept mercury as a cause and the evidence were reported to the Diet. The Ministry of Health and the Ministry of Industry, however, objected to this interpretation of the data, and the Diet dissolved without any decision, while scientists at Kumamoto University also carried on with research about the cause of the disease. Professor Iriyama showed that Methyl mercury chloride should be emitted by the factory. However, Chisso criticized the evidence and negligently continued to release Mercury into Minamata Bay.

Around 1968, Minamata disease finally drew public attention. This was largely because of grassroots efforts by victims and information through media. Also, the court found for the plaintiff and formal government acknowledge was announced in 1971. With response to this movement, the Prefecture Assembly Doctor's Group was formed by a few volunteer doctors who thought it important to deal with the problem and made home visit for medical check ups. They collaborated with the Kumamoto University scientists, since the local government still did not approve investigating the prevalence. The result brought an important step that the government acknowledge the existence of disease and to take policy measures. The doctors group Detailed symptoms and diagnoses and tracked the spread of the disease were also useful to facilitate compensation measures particularly setting the criteria. Having raising awareness, more clinicians committed on this issue, and 100 volunteer doctors started check ups in 1976.

The Minamata case shows that doctors, local government public health officers and epidemiologists, at least in the beginning, carried out their expected roles, finding cases, reporting them to the public health office which could relay them to the Ministry, and conducting epidemiological studies. They were, however, trampled by political power and money, and this led to a loss of their attention and sense of responsibility. The evidence was not used, at the beginning, for decision-making toward a

solution because of the strong industrial policy which prioritized health below industrial development. In other words, evidence showing the health damage of the environmental problem was not sufficient to effect policy decisions. Epidemiologists and health administrators could not use the evidence to bring policy change until the government and society experienced the disaster and realized the needs for the change. In the area of science, epidemiologists did not challenge to the policy with the excuse of lack of epidemiological information, neither discussion how to use the data for the social action to the health damage. Moreover, the health specialists were withdrawn from political argument, and the data was not used for policy making.

3-2 Itai-itai Diseases– Evidence changed the company's stance of concealing

The outbreak of the deadly Itai-itai disease in areas along the Jintsu River in Toyama Prefecture was caused by cadmium contamination of water and agricultural products. The main symptom of the disease is extreme brittleness of the bones in the extremities accompanied by severe pain. Cadmium, a heavy metal, blocks a small urine tube in the kidney which prevents the kidney from re-absorbing Calcium. As a result, a substance is excreted in urine that makes the bones very brittle. Patients with the disease says "Itai-itai means ouch-ouch" so this diseases is called Itai-itai disease. This case characterizes how research evidence can urge companies and the Ministry to change positions and policy.

Epidemiological research on initial disease began in 1952 by a team at the local Kanazawa University. The low level of medical knowledge on the disease, and the lack of systems and collaboration within health facilities made it difficult to obtain reliable and comparative data. In 1955, the research result was reported at the Japan Surgical Society Conference, and much research followed. In 1958, at the Toyama Prefecture Medical Association, Dr. Ogino reported that the disease was caused by the Jinzu River, although the report did not implicate Cadmium. This evidence did not, however, result in positive change; instead it brought criticism and attacks toward the researchers by industries and collusive researchers. In 1960, the local government established the Kougaitaisaku-kyougikai or pollution problem committee, and asked an agriculturist, Mr. Yoshioka, to investigate the disease in collaboration with the local agricultural cooperatives. Yoshioka pointed out the harm of cadmium, but the research team and the local government did not have the courage to report the evidence since it related to the Kamioka Mine, which supported the local economy. The prefecture government, at that time, was aware of the caused relationship between the waste from the mine company and the disease, but tried to hide it in order to keep the financial benefit of the company. In fact, the prefecture formed another research team in the hope of contradictory findings; because this research team failed to make up data showing the reverse result, the team dissolved

without the research conclusions being released.

Some volunteer researchers obtained funds from outside Japan and continued the research from 1961-1966, This research included the comparison of the anatomy of people living near other rivers that differed from the Jintsu in terms of water, sand and food grown. In 1961, a presentation was made at the Sapporo Nippon Orthopedics Association using scientific data from Kanazawa University and local epidemiologists and put the pollution problem on the agenda. At that time, scientific knowledge on poisoning was not sufficient and researchers could not demonstrate the evidence strong enough to persuade all stakeholders. Having the increasing interest on this issue, several research groups were formed funded by Toyama prefecture, the Ministry of Health and the Ministry of Education, but research data could not immediately influence the policy decision.

Trigger was brought by a parliamentarian in the Opposition party in 1967 at the Diet. He brought attention to the problem. This was stated without consensus of the party, the government tried to control the information by keeping it from the media to prevent increasing public awareness. This made the government form a research group to investigate the problem. Data on the severity of the disease was no longer allowed companies to conceal and the government not to take measures. As a result, economic relief began in 1967. This was preceded by the formal acceptance of the disease by the government in 1968.

This case shows how researchers including epidemiologists, confronted the government and other stakeholders, and brought about acceptance of the disease and countermeasures to it. Ten years were needed for the government to make the policy decision and one study was not enough evidence for policy change. The driving force for the policy change was the tenacious and persistent efforts by researchers and change occurred despite research produced in defense of the company and the failure of the government to accept the role of mining industry.

3-3 Yokkaichi Air Pollution – Evidence brought resolution at the court -

Yokkaichi is the name of a city in the Mie prefecture that has a petroleum industrial complex which was established in 1955. Respiratory disorders such as bronchial asthma, chronic bronchitis, emphysema and asthmatic bronchitis, occur there as a result of air polluted with sulfur oxides, dusts and others contaminants. Almost one fourth of the city's population, 55,000 people, suffers symptoms similar to asthma. In this case the scientific evidence provided the power to urge policy makers to undertake a solution to the pollution, but it was ten years before circumstances changed because of the interests and power of government and a business enterprise.

By 1960, the prefecture government had already taken action and formed a consultation committee, *Yokkaichishi Kougaitaisaku Iinnkai*, which consisted of University scientists, the City council and the companies. It was asked to determine causality, and the department of public health at the local university took on the work. In 1962, the consultation published a mid-term report that identified the cause as smoke and fog emitted from the factory, and recommended separating residences from the factories and installing elimination equipment. There was limited technical knowledge in this kind of research both in researchers and government, in 1963 the Ministry denied the results and allowed the company to continue its work.

Doctors reported the cases of the victims at medical conferences. In 1964, University epidemiologists negotiated with the governor and the city councilors and took the initiative to prepare advocacy materials to generate more public attention for the problem of pollution. In December 1964, Yokkaichi city started a compensation system, which was the first such system in Japan. Knowledge and opinion of the local medical associations who had paid attention to victims were applied to provide the criteria of acknowledging victims. The real break through occurred in 1969, in the Yokkaichi City Pollution Lawsuit when an epidemiological study that analyzed causality, and which epidemiologists presented in court, was used as proof of the causal role of pollution.

The various kinds of evidence produced over a ten year period including environmental assessments, prevalence studies, checkup ups at schools and in the community, and laboratory animal experiments, finally affected policy change. Epidemiologists made the data public by reports, and also epidemiologist testified the evidence at the courts. The data were also useful in the introduction and implementation of compensation to victims. Advocacy using the evidence promoted the introduction of purification equipments and urged company's responsibility, otherwise, the sufferers struggles to convey their demand for solution. It shows that a lot were facilitated by evidence, and epidemiologist ensured that data are used for policy making.

3-4 Kanemi Yusho – Possessive right of the evidence and fight to release evidence -

Polychlorinated biphenyls or PCBs in widely used are a variety of industrial applications. In Japan, the production of PCBs started in 1954 by Kaneka Corporation. Concern about the presence of PCBs in the environment began in the 1960s. In 1968, there was a widespread human poisoning from PCBs in western Japan, a disease called Yusho or oil disease. Consumption of PCB-contaminated rice bran oil resulted in a severe form of acne called chloracne as well as fatigue, nausea, liver disorders and an increase in mortality from liver cancer.

In spite of announcements of the pollution in 1966 and reporting of the first case in 1968, research was not started until 1970. In 1971, with response to the media report of the data by an institute at Kyoto, similar research data revealing the problem were came about, unless otherwise researchers hesitate to open up. The epidemiologists at the research center in Kyoto tried to report the data at an academic conference as they thought it profound evidence for human health, but they were stopped by opposition from the local government. Researchers could not withstand after all, but instead, reported the data at an internal conference, which invited a representative from the Ministry of Health. However, the government officer did not pay attention to the data for policy change rather directed researchers not to release the data.

Journalist who had a will reported the issue with response to the fact that the data were released at the scientific conference. Opening the data at the conference allowed media to use information without government's instruction. Information dissemination generated public awareness and in 1972, a consultation committee, PCB Osen Taisaku Kyougigai, formed by nine Ministries including trade and construction, formally acknowledged the issue. In virtue of the court judgment of approving contamination, industry finally paid attention to the harm by the products and PCB. 14,000 people claimed that they were poisoned at that time, but only about 1,900 people were certified as victims by the government. After 35 years, in 2003, the attributed risk of PCB was again brought onto the health agenda, as the government acknowledged the risk of dioxins, of which PCB is one kind, and raised the need for counter measures. Unfortunately, due to the difficulty in research on causality, victims have been left without countermeasures.

In looking back, the epidemiologists commented on the difficult position they were in torn between loyalty to the organization and the evidence. Releasing the data was considered a challenge to the organization to which they belonged and destroyed trust within the organization and their interpersonal relationships. One epidemiologist said that he had always been caught between social demands and his fidelity and morale for the organization. Much research was done on causality and the evidence finally dispelled the political pressure. Their fight to release the data eventually led to public awareness, court decision and policy making.

4. Discussion

The case studies show that epidemiologists at local universities and institutions, doctors in health facilities, and officers of public health administration were aware of the problems, surveyed the effect on population health, and reported their results to the public health administrative offices in a manner consistent with health system mechanisms. However they were unable to get the problem on the agenda or to influence policy decisions, at least in the short period, because of the difficulties in obtaining data, political pressure toward specific conclusions, and the economic disadvantages the solutions might cause. Revealing the existence of pollution problems was unwelcome as it went against the goals of both the government and companies that has political power and funds.

Orientation of Japanese academism also affected scientists' perception and position. Researchers were trained to be honest to the truth and not to make value judgment and respect other scientists' value and opinion, as it illuminated *Wertfreiheit (free from value)* by Max Weber. This ethical behavior led to powerless of the scientist in the political decision making, although apparently some epidemiologists did not observe ethics such as forgery of the data, not retrieving once the mistake was found or immediately left this field as it threatened their position.

There is no getting away from the fact that scientists and epidemiologists could not put pollution on health agenda or bring about policy change, but efforts to collect data change the political climate were effective in the long term. Also, evidence for the solution was brought by some epidemiologists and doctors who had steadily continued their research in spite of criticism, and weathered adversity and the risk of misfortune. Their success highlights the need for continued motivation on the part of researchers or epidemiologists, or mechanism to promote their motivation.

This paper analyzes the situation of evidence and politics as a reason of delays for solution with pollution. This implies required commitment as lessons learned. Discussion was made in terms of: 1) shortcomings of epidemiology, 2) politics in producing evidence, 3) characteristics of evidence in policy making, 4) capability of epidemiologists. Implications for proactive epidemiologists and promoting mechanism are summarized in conclusions.

4-1 Shortcomings of epidemiology

The insufficient power of epidemiology to facilitate early attempts to deal with environmental problems was considered with regard to four characteristics of epidemiology in solution:

1) Difficulty in showing causal relationships

Epidemiology was not powerful with regard to the pollution problem. It was difficult to prove the causality with the environment because of the various fluid and complex factors involved and it is difficult to omit confounding factors. It is common that some research showed the opposite conclusions from others. Objective evidence was difficult to be shown relating to contamination and unknown diseases, as restriction and bias are inevitable in research and prejudices and political leanings exist and are difficult to prevent. Assessment of long-term impact, which required more technical skill, time and funding, were also difficult to conduct. On the other hand, at the grass root level, community and victims, amateur epidemiologists, conducted research to produce sophisticated data close to reality with very limited fund.

2) Low recognition of the first case reports

How the reported first cases of diseases are handled was not inaccurate. Investigations should be started and measures taken to prevent expansion of damage. In these Japanese cases, local public health administrative offices received the reports and tried to take appropriate actions, however first reports were considered profound only after pollution brought more damage, and in most cases the evidence was questioned and corrective measures delayed. Awareness was low and preventive measures and warnings were not made until the damage had expanded and was widely known. With regards to diagnosis at hospitals, early victims were treated without identification of the cause of diseases. Doctors should pay attention to cases with new symptoms their prevalence and the cause of the diseases, and liaise with epidemiologists and health administrators.

3) Inactive scientific discussion

A sound scientific environment to review and discuss the reports or research results was lacking. The academic discussion channels and academic networks did not function to assess the quality of the evidence. There were few epidemiologists with the capacity to evaluate validity and reliability of the research. The limited capacity for reviewing research depreciated the power of the evidence and encouraged misleading research conclusions and manipulated by political pressure. Mechanisms for circulating scientific information both nationally and internationally are limited. Experience in other area was not utilized, therefore the damage was repeated.

4) Political pressure and nepotism

Positioning and opinion of the researchers were influenced by the political pressure of their affiliation, academic clique, and funding agency. Scientists are expected to be faithful to the truth, but in the cases, due to the political pressure and purely due to the capability in epidemiology, the subjective notion and bias are easy to be included, and this brought controversy in conclusions.

4-2 Politics in producing evidence

Political barriers prohibited epidemiologists from conducting research and utilizing the research result. Political pressures were affected in various aspects:

1) Politics in researchers' standpoints

Before the pollution problem was put on the agenda, research on pollution problems was not appreciated and funds were difficult to obtain, and the promotion was prohibited if the person tried to put this agenda. Researchers of various institutes such as local universities, company research teams, and government funded teams had their different agenda, and this led to misleading in conclusions which would be appreciated by the authority like the government and funding agencies. .

2) Politics of accessing data

Providing evidence of contamination is not easy because there are sometimes stakeholders who take action to conceal data or construct obstacles to obtain data. For example, companies contaminating the environment were told of upcoming inspections so that they could clean up their actions for the inspections.

3) Politics in data analysis and research result

Research data are purposely or unconsciously not always scientific. Researchers led the conclusion of the research, or concealed data that would not be welcomed by the authority, or analyzed data using improper methodologies to force the desired conclusion of the research. This was a barrier to producing research that highlighted the pollution problem and encouraged scientific discussion of the issue.

4) Politics in the presenting the results

The organization that owns or funds data often places restraints on their release. This is particularly problematic when researchers are hired by the government or a company, because the research results are controlled by those authorities and researchers do not have the rights to release the data. They are further pressured against releasing data that may be controversial by moral codes that discourage disloyalty to the company. In the Japanese case, data were politicized by the authority, which defined the timing and place of the release against the researchers' will.

4-3 Characteristics of evidence in policy making

These case studies show the relationship between politics and evidence. In the solution to the Japanese pollution problem, scientists were not proactive so that research result to be utilized. Not a few researchers expected that research data would be utilized and facilitate corrective policy measures, but in vein. Researcher should realize that they have social responsibility with authority and can influence how the data to be utilized instead of not giving way to politics.

Scientists should be aware of the following reality as lessons learned, and should be prepared to act proactively in dealing with the situation

1) Power of the evidence does not depend on the quality of evidence
Even if the evidence is scientifically sound, it does not always affect for policy decision making. Policy decision will be made based on the endowed authoritative power of the evidence and political climate particularly with balance of other issues. Within many research and conclusions, few selected evidence influenced the decision.

2) Evidence is often produced to justify certain decision
Research has been conducted to justify certain opinion or position. Moreover, policy makers sometimes did not pay attention to the evidence unless the research was initiated by them.

3) Evidence is one of the several measures for policy making.
Policy decision is made with regards to various means as well as research evidence. Researchers should be aware that academism is expected to investigate one particular issue or field, and demonstrate one proposition, which is different methodology of policy making finding balance reviewing all the relating issues and stakeholders.

4) Evidence has the power to influence people and policy if the occasion is provided.
Evidence was put forth and had the power to influence the situation when it was used at the court or in academic associations that values scientific quality. Researchers should make the most of these opportunities by paying attention to who exercises the authority of science.

5) The quality of evidence will be refined through academic discussion.
To improve the scientific quality and avoid political pressure to the research results, research and data should be open to discussion. It is essential that research results should be examined critically and scientifically. This facilitates improvement of the quality of evidence with synergism by disseminating information and avoids duplications.

4-4 Capability of epidemiologists

From the cases in this article, moving scientific findings into policy changes requires informed and committed epidemiologists. There were several similarities and particular ways in those epidemiologists who broke through political pressures and dealt the situation. Those points are as follows, and epidemiologists are expected to have those skills and to be provided training that is currently lacking. Epidemiologist who acted proactively had capacity:

1) To make advocacy toward politicians to influence the government and industry
2) To mobilize grass root leaders and action
3) To encourage populations at risk to be aware and protect their health by themselves
4) To produce collaboration with other researchers and professionals
5) To present the data in influential way
6) To link with media
7) To bring the data to the court

5. Conclusions

The Japanese experiences highlight the differences in incentives and interests in politicians, government officers, industries and scientists. Doctors and epidemiologists had a tendency to be faithful to the science, or pursue truth, without paying enough attention to the political climate. Policy administrations and companies used the evidence that supported their position, instead of seeking truth. This delayed raising awareness and aggravated the severity of the problem, even though good evidence existed.

The underlying purpose of epidemiological research is to use inferences to prevent disease and promote health. The pollution problem in postwar Japan shows, however, that despite evidence on harmful exposures from environmental epidemiology studies, preventive action was lacking on many fronts. Decision making involves choosing among alternative ways of meeting multiple objectives that are in competition or in conflict, and accepting the uncertainties and the value of data. From the case studies, it is clear that uncertainty and conflicts can produce diverse conclusions or lack of action and end in significant adverse consequences.

Policy makers and medical professionals currently pay attention to evidence-based policy making or evidence-based medicine. Results from epidemiological studies must be translated from theory into public health policy. Epidemiologists are expected to play effective function to translate results into appropriate policy. Even if the issue is politically controversial, epidemiologists should provide the right type of data for decision making and communicate the results of environmental epidemiology studies in a form understandable to policy makers so that action will be encouraged. Epidemiologists should know their function in society to play in the process of addressing the solutions to the problems.

There are several factors that limit the ability of epidemiologists to move into public health action, such as research funds, data generalizability, and political and advocacy skills. Scientists, particularly epidemiologists, should learn from these experiences that evidence alone does not have the power to raise awareness of problems like pollution, and more proactive capacity to avoid unnecessary politics and to present the data so that scientific knowledge can be used for policy making.

The difficulties epidemiologist faced provide lessons regarding the function of public health specialists or scientists in general. To reduce the barrier, social mechanisms or devise should be established; even the issue was politically controversial.

1. Improvement of epidemiological skill in government health administration

Government is expected to take the role of gathering reports and results from various information sources and evaluating them so that they are reflected in policy making. Technical skills to understand research should be strengthened so that government can assess the quality of the evidence and take appropriate decision based on scientific soundness in stead of the mercy of politics. Human resource training and its posting should be reconsidered.

2. Going government information public

Opening government administrative information into public with understandable description is effective to facilitate evidence based policy making. If process of the policy decision and its grounded data were explained, fair and balanced decision making will be made. Controversial issues should be openly discussed with specialists in multiple fields and civil society.

3. Valid academic evaluation and ethical assurance by the third party

Open discussion are also needed within the academism. Academic conferences, research groups should play a role providing the opportunity to disseminate information, and evaluating the quality of the results and evidence. A third party committee for monitoring and evaluating the transparency and accountability of science are important to deter nepotism, manipulation of data and misleading conclusions. Ethics and responsibility of the researchers and their evidence should be more assured by the third party. Mechanisms also can be developed to release information to the public through the media.

4. Decentralization and collaboration with local epidemiologists

Japanese experience showed the active commitment of the local government for solution. Local government considered monitoring and assessment of health as their role, but they had not provided enough authority to take decision and implement measures for solution immediately. Decentralization should be brought in more practical aspect such as approval and fund allocation. To make this realize, public health offices could be more trained in planning and implementation with long-term perspectives and social perspective. Decentralization also makes it possible to empower local epidemiological institutes as collaborative agencies of local health offices.

5. Improve authority and responsibility of the leading Ministry

Japanese experience showed the unnecessary delay for the measures, this implies that the Ministry to deal with health issue did not have enough authority or commission to take measures, and in exchange, the Ministry was not accused for irresponsibility for the health of the public. Authority