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Invited Article

# Towards Elimination of Asbestos-Related Diseases: A Theoretical Basis for International Cooperation

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We develop a theoretical framework for international cooperation that can be used for the elimination of asbestos-related diseases (ARDs). The framework is based on the similarities in the temporal patterns of asbestos use and occurrence of ARDs in diverse countries. The status of each nation can be characterized by observing asbestos use and ARD frequency therein using a time window. Countries that supply technology for prevention of ARDs can be classified as donors and countries that receive these technologies as recipients. We suggest identification of three levels of core preventative technologies. Development of a common platform to gather and manage core preventative technologies will combine the strengths of donor countries and the needs of recipient countries.

**Key Words:** Asbestos-related diseases, International cooperation, Developing countries, Prevention, Asian Asbestos Initiative

## Introduction

Many countries have used and continue to use asbestos, and it has been documented that such countries often show similar temporal patterns of asbestos use and the prevalence of asbestos-related diseases (ARDs) [1-6]. However, these findings have rarely been utilized to formulate a theoretical basis for international cooperation to eliminate ARDs.

Raw asbestos use by a nation typically increases rapidly during the early stages of economic development, then peaks, and then commences to trend downward [7]. Asbestos use ends when a country adopts an official or *de facto* ban (*i.e.* no further use of asbestos). This point delineates the transition from "asbestos-dependent" status to "banned" or "post-asbestos" status.

The use of raw asbestos will ultimately lead to an increase in ARDs. However, this is usually seen during the downward trend in asbestos use [6]. More importantly, new ARD cases continue to increase as a country transitions to "post-asbestos" status. In diverse countries with histories of raw asbestos use, the frequency of ARD cases over time shows similar features, and a characteristic ARD epidemic curve often develops. The lag time between the asbestos-use curve and the ARD epidemic curve is typically 20-50 years [2,3,8]. Thus, many developed countries in the "post-asbestos" period have been seriously affected by epidemics of ARDs.

## Looking through the Time-Window

Historical events, such as the temporal pattern of asbestos use and the development of an ARD epidemic, can be viewed through a time-window (Fig. 1). In the case of Japan, the final,

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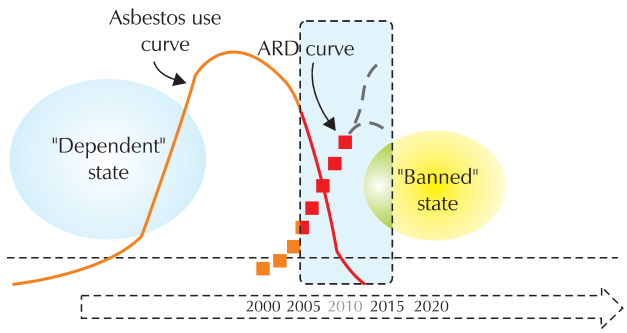


**Fig. 1.** Observing a national situation through a time-window (hypothetical). The epidemic curve of asbestos-related diseases (ARD curve) appears as a sequel to the "asbestos-dependent" period and defines the "banned" or "post-asbestos" period.

waning period of the asbestos-use curve coincides with the initial, rising segment of the ARD epidemic [5]. For many developing countries, the section of the asbestos-use curve associated with the status of "asbestos-dependence" can be readily identified, but the prevalence of ARD remains low, most likely because of a lack of recognition of ARDs and because at least 20 years must pass from asbestos exposure to development of ARDs.

Based on the similarities among ARD epidemics in developed countries, we expect that the initial phase of the ARD epidemic curve will soon occur in many Asian countries. In support of this notion, we recently found a high correlation between the cumulative level of asbestos use and mesothelioma case numbers using national-level empirical data from around the world.

We suggest that, within the next decade, the international community should promote worldwide cooperation to enhance the transitions of countries from the "asbestos-dependent" status to the "banned" status, and should also encourage the early detection and efficient management of ARDs. Neither one of these activities alone will be sufficient to eliminate ARDs.

## Classification of Countries

To construct an efficient framework for international cooperation, countries should be placed into one of the three classes based on asbestos use and prevalence of ARDs.

Group I countries have the following characteristics: (i) asbestos has been banned officially or *de facto*, and (ii) ARD frequency is increasing or approaching a maximum. Most developed countries in the Western world are in Group I; such countries include the USA, those of Western, Northern, and Southern Europe, Australia, New Zealand, and South Africa. In the Asia-Pacific region, Japan, Korea, and Singapore are in Group I.

Group II countries have the following characteristics: (i) asbestos use is increasing or has just started to fall after many years of sustained use, and (ii) reports of ARDs are almost *nil* or have just started to rise in number. Group II countries include Russia, Kazakhstan, those of Eastern Europe, and possibly Middle Eastern countries. In the Asia-Pacific region, many countries classified as "economically developing" belong in Group II, including China, India, Indonesia, Malaysia, Mongolia, the Philippines, Thailand, and Vietnam.

Group III countries have the following characteristics: (i) raw asbestos is either limited in use or the extent of use is unknown, but asbestos-containing products are probably employed and treatment of asbestos-containing waste is likely to exist, and (ii) the extent of ARDs is generally unknown because of a prevailing lack of awareness. Countries in Group III include all African countries, except for South Africa. In the Asia-Pacific region, the Pacific Island countries are in Group III.

In the process of transferring technologies that can help to prevent ARDs, Group I countries are on the supply (donor) side, and Group II and Group III countries are on the demand (recipient) side. Some qualitative differences in the demand characteristics of Group II and Group III countries will be evident. It should also be noted that the sharing of technologies within the countries of a Group will be mutually beneficial.

## Complementing Strengths

We previously proposed that a traditional public health approach should serve as the basis for development of intervention strategies seeking to eliminate ARDs [9] Thus, various specific technologies can be used to implement different types of prevention. For example, at the "primary prevention" level, air sampling and measurement of asbestos fiber numbers in the work environment are core technologies that should be shared. At the "secondary prevention" level, the relevant technologies include follow-up procedures for exposed individuals, such as radiography for detection of pleural plaques, asbestosis, and cancer. At the "tertiary level", technologies include effective treatment of ARDs, in particular, the development of new treatment modalities for mesothelioma, and the introduction of equitable compensation schemes.

The time-line for a society to deal with asbestos problems stretches over many decades and countries acquire the relevant knowledge and experience along the way. During the early phase, when a country is in an "asbestos-dependent" state, development of the science and technology needed for primary prevention of ARDs takes precedence. During the "post-asbestos" period, secondary and tertiary prevention becomes critical, as the society faces an increasing prevalence of ARDs. Thus, when international cooperation is in place, a country will need to acquire different prevention technologies based on the relevant status. To this end, we encourage countries to regularly compile their National Asbestos Profile, which is designed to include information on asbestos use and risk to workers. This Profile is annexed to the National Programmes for the Elimination of Asbestos-Related Diseases (NPEAD) [10] and can assist in dealing with all aspects of asbestos-related problems.

For example, both Japan and Korea recently entered "post-asbestos" periods, but these countries differ in the overall time-course of their related events. Japan promulgated a ban in principle in 2005 and a total ban in 2006, whereas Korea promulgated a ban in principle in 2006 and a total ban in 2009 (after ratifying the ILO Asbestos Convention in 2005 and 2008, respectively). On the other hand, the ARD epidemic in Japan preceded the epidemic in Korea, primarily because Japan increased asbestos use earlier than Korea. Given these circumstances, we suggest that Korea may be a suitable supplier of primary preventative technologies, such as industrial hygiene techniques, and Japan may be a valuable supplier of secondary and tertiary preventative technologies (note that Korea's secondary preventative technologies are also developed, but the Japanese experience in this area is more extensive due to the larger number of cases). Systems that are "contemporary" can be shared without much difficulty, and the expertise of different countries (such as Japan and Korea) will be complementary.

In addition, countries on the demand side should seek suitable combinations of technologies for the prevention of ARDs. If asbestos use is prolonged, primary preventative technologies will be essential. The type of technology and extent to which secondary and tertiary preventative technologies will be combined will depend on the prevalence of ARDs. If ARD cases have already been reported, secondary and tertiary technologies should be emphasized; in particular, case verification will be required to improve the accuracy of diagnosis. However, even if reports of ARDs are limited, screening and surveillance (secondary prevention) cannot be ignored, particularly if a country has experienced an "asbestos-dependent" status.

In an on-going international cooperative effort to eliminate ARDs, exemplified by the Asian Asbestos Initiative [9], a consortium of academics, practitioners, and national administrators, in collaboration with international organizations, has developed a common platform to gather core technologies that can be readily shared and transferred. Based on the tragic lessons learned by countries with experiences of ARD epidemics, the relevant expertise and technologies include disciplines such as industrial hygiene, engineering, clinical medicine, and social sciences. We suggest development of a system which ensures that all contributing parties, including supply-side countries, benefit from multinational cooperation (Fig. 2).

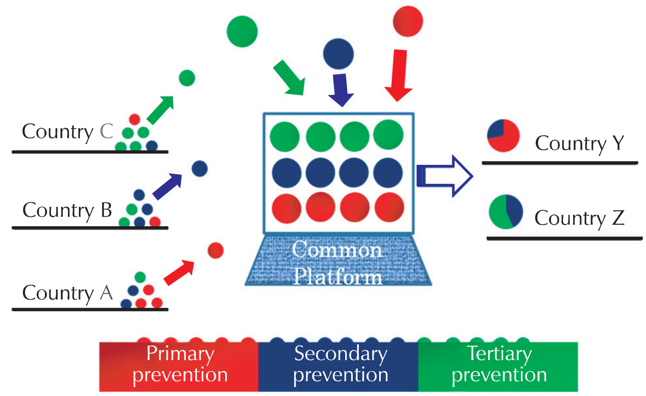


**Fig. 2.** Optimizing transfer of technologies for primary, secondary, and tertiary prevention of ARDs. The donor countries (left) contribute specific core preventative technologies in which they have expertise. These technologies are compiled and managed on a common platform (*e.g.*, the Asian Asbestos Initiative [AAI]), and are made available for transfer and sharing. The recipient countries (right) will seek an optimal combination of core technologies based on specific needs.

## Conclusions

We agree that the most effective means to eliminate ARDs is to discontinue the use of asbestos [11]. However, national processes often require gradual transition involving progressive steps. Furthermore, ARDs will continue to occur after a ban status is achieved. International cooperation to eliminate ARDs should thus aim to address the full spectrum of related problems. Development of a common platform to gather and manage core preventative technologies will combine the strengths of donor countries and the needs of recipient countries towards the goal of eliminating ARDs.

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