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Health Policy 57 (2001) 79–96

HEALTH policy

www.elsevier.com/locate/healthpol

The public economics of tuberculosis control

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Received 20 July 2000; accepted 21 December 2000

Abstract

This paper identifies specific sources of the failure of private markets to allocate TB control resources efficiently. These market failures, as well as the concentration of the disease amongst the poor, suggest a number of roles for public intervention. Government intervention should aim to either increase, add to, or substitute for private supply, depending on the type of market failure and the institutional capacity of the public sector. © 2001 Elsevier Science Ireland Ltd. All rights reserved.

1. Introduction

To what extent should governments be involved in the detection, treatment and control of tuberculosis? The woeful inadequacy of private supply in some countries, coupled with the abysmal failure of public intervention in others makes this question difficult to answer. This paper tries to take an objective look at the question of public intervention by examining the ways in which private markets fall short of socially desirable outcomes, while accounting for the limitations of public institutions in some countries.

Currently tuberculosis is responsible for 2 million deaths each year, mostly in poor countries. This situation has changed over time: in the 19th century most recorded cases were in the industrialized countries, where TB reduced average life expectancy considerably. Economic development in general, and pharmaceutical

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¹ This research was carried out as part of a World Bank study. Thanks to Chris Dye, Diana Weil, and an internal reviewer at the World Bank for comments and discussions. The opinions in this paper should not be ascribed to the World Bank or any of its member countries.

advances in particular, led to an impressive decline in these countries, although there has recently been a resurgence in some pockets in the US, mostly associated with immigrant communities.² The epidemic in Russia, particularly amongst the incarcerated population, has recently received widespread media attention.

The total number of deaths, while clearly expressing the tragic consequences of the disease, is not particularly helpful in guiding policy interventions. Hammer [[8], p. 3] has made this point with regard to the control of malaria: “That malaria affects so many people in the world is not on its own sufficient to make it an important priority for policy: what matters is whether something can be done about it.” After reviewing two approaches to measuring the economic effects of disease, this paper examines the role of government as either correcting inefficient use of TB control resources, either through direct provision or regulation, or using TB intervention as a redistributive instrument. These are the two fundamental criteria — efficiency and equity — that should guide all public interventions, in health and other sectors alike.

The paper argues that there are strong reasons to favor public intervention due to the specific characteristics of tuberculosis. First, there are clear contemporaneous externalities associated with detection and treatment because of its contagious nature. Second, especially early on in the disease, individuals may not be very well informed about the need for diagnosis because the symptoms mirror those of other less serious health problems. Third, because full treatment requires extended drug therapy over 6–8 months, incomplete treatment is common and contributes to drug resistance. This is a form of dynamic externality. Finally, and perhaps most importantly, tuberculosis is a disease of the poor, and public intervention in its detection and treatment could represent an effective part of an anti-poverty approach to development.

2. Economic analysis and priority setting

Two research techniques have been employed in the international (and other) health economics literature to examine the desirability of public intervention in the control of disease. These can be conveniently labelled micro and macro approaches, each of which attempts to estimate the economic consequences of the disease in question. The micro approach is a kind of “bottom up” analysis of the costs associated with the disease, which essentially aims to account for, and aggregate, the costs associated with lost output, poor health, treatment, etc. to arrive at a measure of the economic impact of the disease.³ The implicit comparison is with a

² The New York Times (1/2/00) reported that 42% of TB cases in the US were amongst immigrant families, who constitute only 10% of the population.

³ Dholakia [2] employs this strategy in a study of TB in India. See Jack [10] for a discussion of the considerable data requirements that must be met in order to arrive at a well-founded welfare measure of economic burden of disease.

world in which the disease is absent, in which case the economic cost can be interpreted as a lower bound on the benefit to society of eradicating the disease.

The macro approach to estimating the economic impact of disease has been popularized recently by, amongst others, Gallup and Sachs [5,7] and McCarthy et al. [14] in the case of malaria. These studies use cross country data to investigate the impact of (various measures of) malaria prevalence on GDP growth, and generally find that disease has a (small) negative impact on GDP growth. The lost output that this impact implies is identified with the economic cost of the disease.

While the direction of this effect is not surprising — one would be alarmed to find that countries with higher rates of disease had, *ceteris paribus*, higher GDP growth rates⁴ — interpreting the results is less straightforward. Indeed, McCarthy et al. explicitly calculate the effect on GDP growth of eliminating malaria. Even accounting for the well-understood limitations of GDP as an indicator of human welfare [19], this figure is only useful if it is compared with the cost of such eradication, which is only likely to be feasible through the development of a robust vaccine.

Thus, both the micro and macro approaches to estimating the economic costs of disease yield results that can be used to assess the choice between eliminating a disease and doing nothing, and are potentially useful in establishing the benefits of developing a vaccine. There are two limitations to this analysis: first, countries have many intermediary choices — expanding TB control programs, improving drug compliance rates, increasing detection, etc. — that may not lead to eradication of the disease. These intermediary choices also need to be considered, not least because the net benefit for such interventions may indeed *outweigh* the benefit of complete eradication, even when the latter is positive.

The second limitation of aggregate economic burden of disease measures is that if they suggest clear positive benefits of eradication, they beg the question of why such eradication (within each country) has not been pursued through the actions of private individuals acting in their own self-interest. One clear reason is the public good nature of the knowledge embedded in a discovery that makes eradication feasible and desirable (see below). But if eradication is desirable (i.e., the benefits outweigh the costs) *given the current treatment techniques*, then there is no public good problem. Perhaps a credit market failure constrains the ability of poor countries to finance the up-front expenses needed to fund eradication. In this case the appropriate response would be for international institutions to provide loans to countries to combat the disease. Alternatively, the actions of private agents in their use and provision of treatment might not be efficient. Removing these inefficiencies should be the goal of governments, within the institutional capacity constraints they face. It is these sources of internal inefficiency, and the kinds of policy responses open to governments, that this paper addresses. Importantly, the appropriate policy response is largely *independent* of the size of the total economic cost of tuberculosis (measured by the total economic cost), and there is thus little reason to go to the trouble of estimating it.

⁴ Don't laugh. Some commentators have interpreted the high death rate associated with AIDS in Africa as increasing per capita GDP.

3. Market failures in the detection and treatment of TB

This section examines the specific characteristics of tuberculosis that lead to market failures in the detection and treatment of the disease, and hence to a role for public intervention.⁵ It should be stressed that this approach is not meant to reflect a bias against public sector involvement in TB control. Indeed, identification of specific shortcomings of the private sector serves mainly to improve the effectiveness of any public intervention.

3.1. Public goods

The benefits of public goods can be enjoyed by one person without detracting from the benefits that accrue to another — they are said to be ‘non-rivalrous’. In a competitive market, providers would not be able to charge a positive price, and so they would make losses, and would thus not produce the good. An additional feature of a public good is that it is difficult to stop people using it — it is said to be ‘non-excludable.’ Even a monopoly, able to set a price above marginal cost, would not make enough money from sales, because it could not stop consumers free riding.

The best example of a public good is knowledge, which costs little to transmit once produced, and can be difficult to stop people using. Patents and other forms of intellectual property rights are sometimes used to induce producers to invest in knowledge. There is a role for government in enforcing such property rights, or indeed in producing the knowledge itself. This provides one explanation for the large role of public finance in research institutes and universities. Amongst epidemiologists and others, much is known about the technical aspects of tuberculosis already. Standard and efficacious treatments exist (especially for strains that are not drug resistant), and the medical aspects of prevention strategies are well understood. Of course, much of this information has been generated with the help of government subsidies, as would be predicted as necessary by the theory of public goods.

Consumption of TB remedies and precautionary measures to avoid it do not constitute public goods. There is no question that they might be in the ‘public interest,’ in some well-defined sense, but they do not represent classic public goods. However, there is a growing belief that some aspects of tuberculosis control have the attributes of *global public goods* [12]. Technically speaking, such goods would be characterized by the fact that they can be ‘consumed’ — i.e., used — by all people in a non-rivalrous fashion. Knowledge of the dynamics of tuberculosis, a disease which can easily be transmitted across borders, including existing patterns of prevalence and incidence, might be viewed as constituting a global public good, because of the risk that without such understanding the ability of any country to

⁵ One source of market failure that is not addressed explicitly is the non-existence of insurance. TB is rare and costly to treat, making it ideal for insurance coverage. Jack [[11], chap. 5] provides a review of the sources of insurance market failure in developing countries.

avoid an outbreak of the disease is compromised. Another example is knowledge about what kinds of interventions are effective — knowledge that can usually only be generated through learning by doing. While there is some argument amongst economists as to the validity of this interpretation, semantics aside, it is useful to make the observation that, to the extent that one country's TB control strategy provides benefits to many other countries, and to the extent that it is difficult to compensate the initial country for providing those benefits, the socially desirable level of intervention will not be achieved when countries act unilaterally. There is then scope for internationally coordinated interventions, or at least for (partial) external funding of such programs.⁶

3.2. Consumption externalities

Sometimes individuals value treatment less than society as a whole, either because their use of treatment directly affects others, in which case an externality is said to exist, or because others value the well being of those with TB, say due to altruism. Let us first examine the effect of such externalities on treatment levels, and the impact of alternative government interventions.

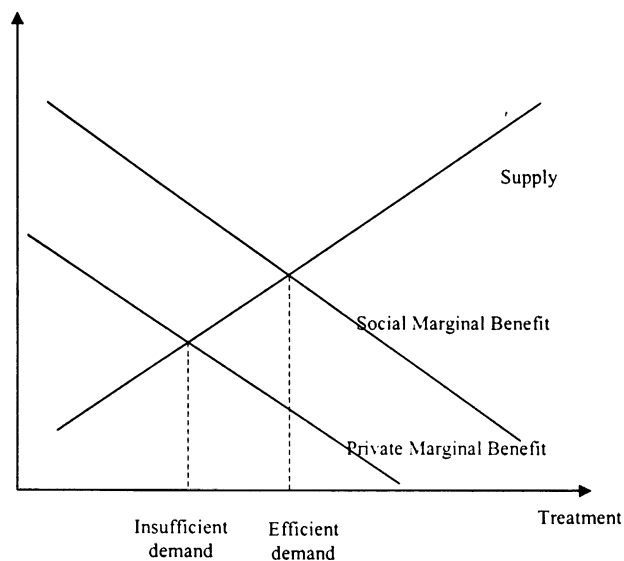


Fig. 1. In the presence of a positive externality, not accounting for the benefit to others, private demand is insufficient.

⁶Of course, as part of a strategy to redistribute resources from the rich countries to the poor, international funding of TB interventions might be desirable, but in principle no more so than direct financial transfers, free provision of immunization services, etc.

3.2.1. Externalities and public intervention

A positive externality means that an individual's demand curve, reflecting her private marginal benefit of treatment, will lie below the social marginal benefit curve, as in Fig. 1. In order to expand the use of treatment, the government could subsidize its consumption, effectively shifting the private demand curve up, or subsidize its provision, shifting the supply curve down. Alternatively, instead of changing prices directly through the use of a subsidy, the government could induce a price fall by increasing the supply of treatment — i.e., by providing some of the service itself. It is important to note that public provision is likely to result in some *crowding out* of private supply, since one result of a falling price is a contraction in the willingness of private providers to supply the market. For this reason, in order to increase the level of treatment to the efficient point, the government will have to provide more than the difference between the existing inefficient level and the desired amount.

An extreme case of crowding out occurs when the supply curve is flat. In this case, any public provision is matched one-for-one by a contraction in private supply, and in order to reach the efficient level of treatment, the government will have to provide the full amount of necessary care. On the other hand, no crowding out occurs if there is a fixed private supply — that is, if the private supply curve is vertical. However, in this case, the negative externality has no impact on efficiency, so there is no need for the government to augment supply.

There are three sources of consumption externality associated with fighting TB. One is linked with the tendency of individuals to delay diagnosis, and the other two are associated with incomplete drug therapy. Of this second pair, one is contemporaneous in nature as it leads to higher incidence rates, and the other, relating to the development of drug resistance, is dynamic.

3.2.2. Diagnosis externalities

Tuberculosis may reveal itself first as a persistent but otherwise unremarkable cough, general fatigue, or other forms of lethargy, but is difficult to immediately identify without expert diagnosis. Even so, at the early stages individuals can pass on the disease to others, meaning that early treatment has benefits for others.

The decision to seek diagnosis can be thought of as an investment. The costs associated with this action might include monetary payments to the provider, forgone wages or leisure, travel costs, etc. Diagnosis is an investment because it provides information, which is durable. In addition, the investment is irreversible. That is, the resources spent on acquiring the information cannot be recovered. Finally, there is appreciable uncertainty about the return to the investment, on the part of the consumer — in a sense, the investment only pays off if he/she has the disease.⁷ Dixit and Pindyck [3] have shown that irreversible investments under uncertainty will optimally be delayed. That is, there is a benefit — an 'option value'

⁷ This might be not quite true if individuals have a preference in favor of resolving uncertainty — that is, if they prefer to know for sure that they have TB or not, rather than being unsure about it. It should be noted carefully that a preference for resolution of uncertainty is different from risk aversion.

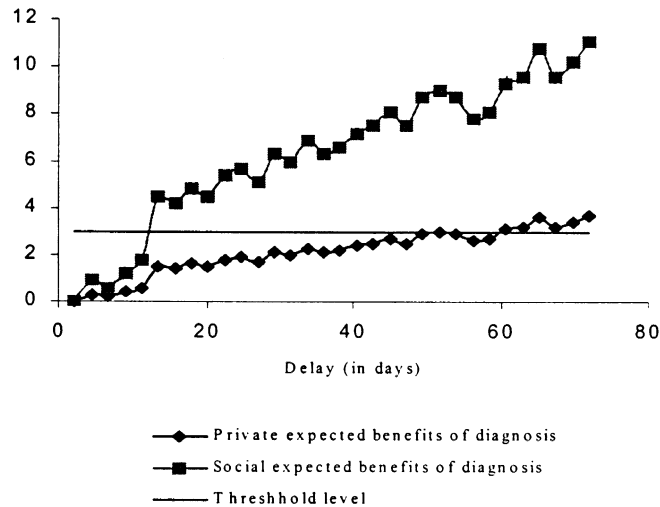


Fig. 2. Private and socially optimal delays in seeking diagnosis.

— to waiting for uncertainty to be resolved. In the case of TB diagnosis, this benefit derives from the fact that a persistent cough need not result from tuberculosis bacilli, in which case TB treatment is ineffective.

In making his/her decision to seek diagnosis, the individual weighs the benefit of early detection with the cost. In general there will be little uncertainty about the cost. However, since diagnosis is only useful (to the patient) if it reveals infection, the expected benefits of diagnosis are equal to the actual benefits (reduced severity of disease and easier cure) times the perceived probability of having the disease. Now, over time, this subjective probability changes with the severity of the patient's symptoms. The severity of symptoms tends to fall as the individual recovers from what was a bad cold, or it increases if the persistent cough turns ugly. However, because the symptomatic dynamics are stochastic, it is difficult for the individual to infer from them his/her disease status. Only when the symptoms are bad enough is the perceived probability of having TB high enough for the expected benefits of diagnosis to outweigh the costs, in which case medical attention will be sought. Uplekar [20] reports that the average delay between the first symptoms and diagnosis is about two months in India.

This is a rational response for the individual. However, while he/she is waiting for uncertainty to be resolved (i.e., waiting to find out how likely active infection is), other individuals may be infected. Including this potential cost of delay (it is also uncertain, as the individual may not be infected of course) increases the expected social benefits of diagnosis, thus shortening the optimal delay of diagnosis.

This discussion is portrayed in Fig. 2, using fictional data for the purposes of illustration. On the horizontal axis is measured the length of delay before seeking diagnosis. The lower jagged curve measures the expected private benefit of seeking diagnosis, which evolves over time in a stochastic manner as the symptoms the

individual experiences develop. The decision of when to seek diagnosis takes the form of what control theorists call an optimal stopping rule: when and only when the net expected private benefit reaches some threshold level, \bar{B} , should the individual seek diagnosis. Alternatively, this condition can be expressed in terms of the gross expected private benefits being greater than the threshold level plus the cost of diagnosis, since $\pi B - C > \bar{B}$ if and only if $\pi B > \bar{B} + C$, where π is the (stochastic) probability of having TB, B is the private benefit of diagnosis, and C is the cost of diagnosis. Diagnosis is thus sought after a delay of about two months in the figure.

However, from a social perspective, the net expected benefits of diagnosis include those that accrue to others who benefit from the potential TB sufferer getting early treatment in the event that he/she is indeed infected. The socially optimal stopping rule then suggests that diagnosis should be sought as soon as the net expected social benefit is above \bar{B} . Equivalently, diagnosis should be sought when the gross expected social benefit is greater than $\bar{B} + C$. Since the private benefits of diagnosis are related to the reduced time during which the individual suffers from the disease, the social benefits are a function of the rate at which the individual would otherwise infect others. A generally accepted case reproduction number is around 2 — that is, on average an infectious person transmits the disease to two additional individuals.⁸ However, in countries where TB incidence is increasing, this number could be as high as 4. Using the lower figure, the gross expected social benefit of diagnosis is about 3 times the private value. Fig. 2 shows how this reduces the optimal delay from two months to 10 days. (It should be stressed that the data used in this example are illustrative only.)

To induce individuals to seek treatment early, the costs of seeking care must be reduced, either through subsidizing the price directly, or by reducing other associated costs. For instance, travel costs could be reduced by providing more diagnostic clinics in remote areas, or even subsidizing transportation costs directly.

Using Fig. 2, in order to induce earlier diagnosis, the gross threshold level including the cost of diagnosis must be reduced by about 65%. Without more elaborate modeling, it is difficult to say a priori what the relationship between \bar{B} and C will be, but reducing C (the price paid by the consumer) to zero by providing free diagnostic services might be approximately optimal. This kind of policy should only be implemented however in conjunction with other measures to ensure that providers of diagnostic services continue to use efficient techniques, such as sputum microscopy in lieu of more expensive and less reliable X-ray techniques. As discussed above, public provision of diagnostic services may be an effective way of

⁸ Dye and Williams [4] note that “Best estimates of model parameters give [a reproduction number equal to] 1.60 (5th, 95th centiles 1.02, 2.67) in the absence of chemotherapy, and when MDR-TB is invading a population where 30% of the population is already infected with M. tuberculosis. With a reproduction number of this magnitude, MDR-TB incidence doubles every 5.3 years while the epidemic is growing exponentially. A ten-fold increase takes 18.6 years. [The reproduction number] would rise to 1.98 (1.29–3.62) if MDR-TB were spreading through a fully susceptible population, i.e., no-one infected with drug-susceptible or other resistant strains except the index case”.

inducing a fall in the price consumers must pay, and thus of correcting the diagnostic externality.

3.2.3. Contemporaneous course completion externalities

Once diagnosed, the individual is in a position to determine the length of treatment he/she adopts. The available data confirm that the probability of recovering from tuberculosis increases with the length of drug therapy. This increase is most rapid early on, and flattens out after about 6 months. For example, Fig. 3 provides a scatter plot of the proportion of successful cures against the length of treatment using data from a series of clinical trials.⁹ The proportion of cures can be identified with the cumulative probability of a randomly chosen individual being cured after a given length of treatment. A simple assumption is that the benefit to the consumer of undertaking treatment for a given length of time is proportional to this probability of cure — thus the benefit of treatment increases, but at a steadily falling rate. Faced with some cost (monetary, discomfort, etc.) of continuing the course, a rational patient will continue treatment until the perceived extra benefits from additional therapy are exceeded by the private costs. Finishing the course is unlikely to be desirable.

This argument is illustrated in Fig. 4. The curve marked MPB represents the marginal private benefit to an individual of continuing treatment at each point in time. This is just the increase in the probability of cure due to extended treatment, times the benefit, b , of being cured. (The arithmetic is available upon request.) Also shown in the figure is the marginal cost of treatment, which we assume is constant at a level c . This can be identified with the cost of drugs plus other factors including travel costs, the inconvenience associated with treatment, possible side effects (if any), etc. For the purposes of this discussion, it is not necessary to specify the

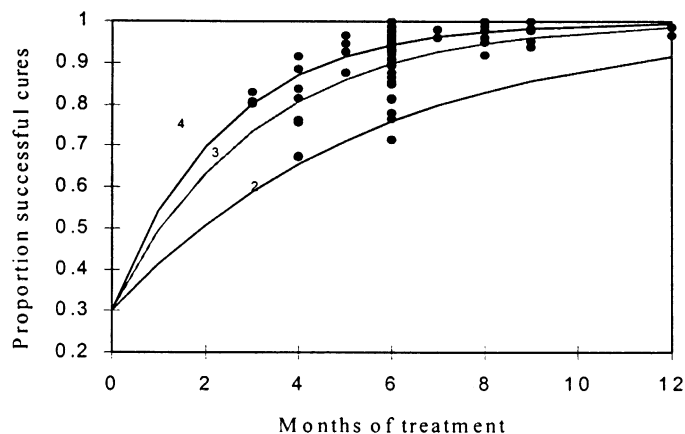


Fig. 3. TB cure rate with months of treatment.

⁹ Snider et al. [18], Cohn et al. [1] and papers cited therein.

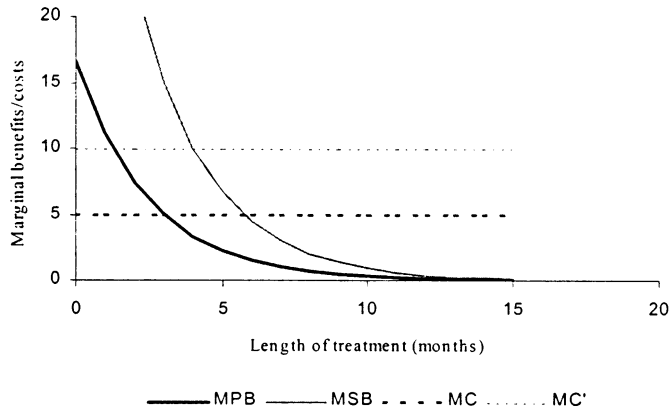


Fig. 4. Privately and socially optimal lengths of treatment.

values of the parameters b and c explicitly. However, given that the average length of treatment chosen by individuals is around 3 months, we can infer a relationship between these parameters such that the marginal benefit of treatment is equal to the marginal cost after this period, as shown in the figure.

By extending treatment, a contagious individual reduces the probability that others will become ill. These additional benefits of treatment can be calculated on the basis of the rate at which transmission occurs, which is generally a function of living conditions, population density, hygiene, etc. As above, we use a figure of 2 as a generally accepted case reproduction number. This means that the social marginal benefit curve, denoted SMB in Fig. 4, lies above PMB by a factor of 3.

The social marginal benefit curve intersects the marginal cost line at a treatment length of about 6 months. Thus, if the contemporaneous externality associated were the only external effect, the socially optimal treatment period would be (on average) 6 months. This level of treatment could be induced by the government by subsidizing the cost of treatment at a rate of roughly 65% ($= 1-1/3$). Since, as mentioned above, the costs of treatment include a number of components, it may be close to efficient for the government to implement the required subsidy by providing material inputs such as drugs and supplies free of charge. Sometimes this is not even enough, and individuals' therapies may need to be directly monitored in order to induce course completion. This is the essence of the so-called DOT strategy (Directly Observed Therapy), under which patient compliance is monitored. In a review of the DOT experience, Volmink et al. [22] acknowledge that reminder letters to clinic defaulters, assistance of patients by lay health workers, monetary incentives, and increased supervision of staff all contribute to higher course completion rates.

3.2.4. Externalities associated with drug resistance

As a consequence of undergoing partial or incomplete treatment, an individual effectively selects relatively virulent strains of the TB bacilli. By stopping treatment

mid-way then, this person not only exposes others to the disease, but exposes them to one that is less easily treated with standard (and relatively cheap) regimens. Very short treatment periods, which are relatively ineffective in killing off the drug-susceptible bacilli, and close to complete treatments which kill off virtually all strains, do not increase drug resistance. But intermediate levels do. The potential for drug resistance to develop means that private decisions about the length of treatment are very likely to be sub-optimal.

This discussion provides a basis for the so-called “window of opportunity” argument for increased TB intervention. If we are to avoid increases in the costs of treating tuberculosis in the (not too distant) future, decisive action must be taken now. If action is not taken in the short term, control of tuberculosis will become unaffordable, and long term reductions in incidence will be dependent on unpredictable and expensive advances in medical technology.

3.3. Supply-side failures

Private providers dominate the medical care sector in many developing countries, providing a variety of services that range in quality from exemplary to quackery. Concerning the treatment of tuberculosis, a number of authors have identified deficiencies in private sector behavior: Ollé-Goig et al. [16] document poor adherence to prescribing norms in Bolivia; Hong et al. [9] found in Korea that sputum examinations were neglected by GPs, and treatment regimens were often inappropriate; in India, Uplekar [20] reported that over three quarters of patients seeing private providers received an X-ray instead of a sputum test, and private practitioners took little action to ensure therapy compliance [21]. On the other hand, consumers use and pay for the private sector, often ahead of the public sector. Uplekar [20] reports that individuals pay on average \$160 for diagnosis and treatment in India.

3.3.1. A framework

In the discussion of demand side failures above, the supply curve in Fig. 1 corresponded to the marginal social cost of providing treatment, and it was assumed that the (equilibrium) market price was equal to the marginal cost at the desired level of treatment. There are two reasons that these assumptions might not hold in practice. First, private suppliers might not use the cheapest or most cost-effective methods of provision. (A good example is the widespread use of relatively expensive and somewhat unreliable X-rays for detection in India [20] and other countries.) When a cheaper production technique is available but is not used, the resulting outcome is inefficient, even if all participants in the market act competitively. Fig. 5 illustrates the welfare loss associated with high-cost treatment protocols. It should be noted that high cost provision is synonymous with poor quality: by interpreting the horizontal axis as “quality-adjusted treatment” even a lower cost but poor quality provider will have an inefficient supply curve as shown in the figure, and improving the quality of treatment can increase the cost-effectiveness even if resource costs increase.

It is not always clear why private providers would use an inefficient technology. One reason could be that they are genuinely unaware of the more cost-effective alternative, in which case the government can respond by providing information directly to providers on the benefits of a switch in technique. There is clearly a similar role for international organizations in disseminating information on new techniques and practices to poor countries. Alternatively, uninformed consumers might ill-advisedly prefer more expensive procedures, even if the quality of the treatment is no better, or indeed worse, than the cheaper variety. In such cases, the government could intervene by directly informing consumers and correcting their mis-perceptions, and might reinforce this message by taxing the more expensive technology and/or subsidizing the cheaper one. If the quality of government services in general is sufficiently well respected by individuals, it could provide treatment itself using the cheaper technology, providing a kind of demonstration effect that would induce private suppliers to also adopt the more cost-effective treatment method. However, if the government is renowned (rightly or wrongly) for providing poor quality services, such intervention might be less effective.

The other failure on the supply side arises when providers have some monopoly power. In practice this means that they are able to charge a price above cost and increase their profits, at the same time cutting back on supply. This familiar source of market failure could be corrected through direct regulation, that is, by the government setting the price at which providers must sell treatment at the level corresponding to the benchmark case. Alternatively, the government could drive prices down by introducing competition into the market, for example by reducing

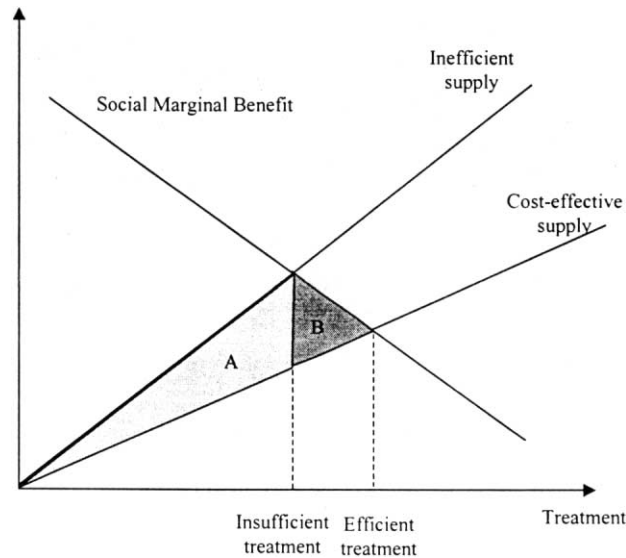


Fig. 5. Switching from an inefficient technology to a more cost-effective one yields two benefits: cost savings for the treatment already provided (A), plus additional benefits associated with expanded treatment (B).

entry barriers to new providers, perhaps by reforming labor practices that artificially restrict supply (under the assumption that the quality of services did not deteriorate when such practices were reformed), or by increasing the supply of qualified providers through education and training policies. Public provision of services could serve this role of increasing competition on the supply side, as long as civil servants were permitted to compete on equal terms with private providers (e.g., having freedom to choose opening hours, ancillary services, etc.).

3.3.2. *Supply side problems in TB*

Despite being charged a fee, even when publicly provided care is free, patients often prefer private care because of convenience factors — flexible payments, convenient opening times, willingness to make housecalls, etc. Also, the private practitioner may be known and trusted in the local community, so his/her advice can attract a premium over that of a public bureaucrat. Lewis et al. [13] report a similar preference for fee charging private providers over free public care in El Salvador. These features illustrate the well-known fact that demand for health care is a function of more than just medical expertise and efficiency (see Gertler and van der Gaag [6] for a review).

It is important to note that, while in the short run consumers may have some preference for either private or public provision, in the long run it is the quality of the service (including convenience, etc.) and its price that determines consumer responses. This does not mean that public care should be abandoned in favor of sub-standard private care: if better quality care is desired, either more resources need to be put in to public care, or the private sector must be regulated and induced to perform better. This too will nearly always require a subsidy of some kind.

It is noticeable that the issue of market power, the primary source of supply side market failure in orthodox economics, receives little attention in the empirical TB literature. However, there is a sense in which poor quality services can only arise if providers have some market power, since providing poor quality is like charging an excessively high price. If providers are competitive, then as long as at least some providers are knowledgeable about cost-effective procedures, these should attract most of the demand, inducing others to lift their performance. But when it is difficult for consumers to switch providers, particularly in rural areas, such competitive discipline may be lacking, and low quality care can persist.¹⁰

Direct public provision may not automatically correct problems of poor quality provision. Just as private providers must be given incentives to use the right diagnostic techniques and to ensure patient compliance with treatment regimens, so too public employees need to be motivated. Especially in remote areas, monitoring of performance is difficult, so some discipline must be exerted by consumers themselves. But competitive discipline can only be exerted by consumers who have a meaningful choice of provider, suggesting that full monopolization of service provision by the public sector may not be prudent.

¹⁰ Uplekar [20] notes that consumers in India typically shop around before being diagnosed.

Recognizing the role of existing private providers, and the limitations on governments to deliver on all components of quality, Pathania et al. [17] have examined the notion of ‘franchising’ the DOTS (Directly Observed Treatment: Short Course) strategy in urban India. The idea is that, just as the fast-food chain McDonalds may franchise its products and method of doing business to individual stores that can benefit from name recognition etc., the government can franchise a TB treatment strategy to providers. This is successful if consumers respond to the brand name of ‘the government’ desirably, so that providers do not have to establish a reputation independently. Of course, just as McDonalds must ensure that its restaurants use the right recipe in order to maintain the good name, the government must ensure that individual providers adopt appropriate treatment protocols in order that the value of the franchise does not fall.

Finally, private supply is sometimes interpreted as failing when it does not provide high quality treatment to the poor. This may indeed be a social failure, but it is more a consequence of poverty than the ambivalence of greedy doctors. Poor people receive poor quality services across the board, not just in the case of medical care, and indeed, in many countries they receive poor quality public services as well [15]. This leads to the question of equity.

4. Equity

Defining and agreeing on equity objectives in general can be controversial, primarily because it necessarily results in policy choices with winners and losers. The room for disagreement is even greater in the realm of health care. Some commentators aim for equal health outcomes for all, others for equal access to health care resources, and others to equal levels of well-being more broadly defined. What equity arguments call for public intervention, in addition to those associated with correcting market failures?

Taking the first view of equity — equality of health outcomes — suggests we examine the pattern of tuberculosis infection and disease across the population without reference to other measures of well-being, such as income. Assuming that eradication is not immediately feasible, the goal of complete equity of outcomes is unattainable, as most people never suffer from TB, while a few do. Within the group of TB sufferers however, there is also a range of outcomes — some have good treatment and recover fully, while others suffer the ultimate fate, death. Without further analysis of the determinants of the outcome of TB infection, it is difficult to recommend specific policy interventions. Either there is a difference in willingness to pay for treatment (which is likely to be highly correlated with income), or in the costs of treatment (which can be extreme when services are unavailable).

It might be easier to concentrate on inputs rather than outputs. Thus, instead of aiming for equal health outcomes, policy might be directed towards equal access to health services, in particular TB treatment. Individuals having equal access can be interpreted as them facing equal prices for treatment. Thus rural clinics, that might

be costly to run, could attract a subsidy relative to urban clinics, to ensure TB sufferers in each location faced the same price of treatment. But again, this says little about equity between sufferers and non-sufferers. The fact that non-sufferers face the same price for TB treatment as sufferers is not particularly useful in measuring the relative well-being of members of the two groups, as one has greater needs than the other.¹¹

A broader view of equity allows more rational interventions. Let us assume that governments wish to redistribute from those who are better off to those who are worse off. The main determinant of well-being is income, but even the most sophisticated tax and transfer systems introduce distortions and costs, limiting the amount of redistribution that is feasible or desirable. Within this context, is there a role for the subsidization or provision of TB treatment, as a means of effecting a more equal distribution of resources in the economy?

Comprehensive data linking TB and measures of income or wealth are not widely available. Rieder (1999, Fig. 36) [24] reports data from 1910 showing that in three countries (Germany, Norway, and Vietnam) prevalence rates were substantially higher (sometimes double) amongst the poor compared with the rich. Similarly, the World Bank [23] poverty report for India shows that TB incidence is negatively related to an index of wealth (p. 28). Indeed, that analysis showed that although the number of TB cases was lower than the number of malaria cases (by a factor of 10 or more), TB was more heavily concentrated amongst the poor.

Because of the correlation between income and TB incidence, the answer to this question is a qualified yes. Imagine that all the poor, and only the poor, suffered from TB. Then free treatment financed by taxes on the non-poor would represent an efficient means of transferring resources, as TB would act as an indicator of poverty. Of course, the correlation between TB and poverty is not 100%, so free treatment will exhibit both type I and II errors (i.e., some sufferers of TB are not poor, but would receive the subsidy, and some poor people do not suffer from TB, so don't receive the transfer).

This discussion suggests that TB status can be used as an indication of eligibility for public transfers. However, despite the language of the preceding paragraph, what it does not necessarily imply is that such a transfer be made in the form of TB treatment. It is possible to imagine a transfer scheme that uses TB as a criterion for receiving, say, food subsidies or education vouchers, if it is desired to target these to the poor. So the second part of an equity argument for TB intervention is that TB treatment can raise the well-being of the poor in a cost-effective manner.

First there is the self-selection argument. If cash transfers are made to TB sufferers, incentives for fraudulent behavior will arise, and the good targeting properties of TB status will be diluted. On the other hand, only people with TB have an incentive to claim and receive treatment for it.

¹¹ This is a version of Sen's capabilities argument. Equality of opportunity is a function not only of individuals' access to resources, but also their ability to transform these into final outputs that are of intrinsic value (e.g., health in this case).

Second, economists sometimes worry about the efficiency of making transfers in kind — e.g., giving foodstamps to someone who needs medical care is not an efficient use of public funds. This seems of little importance in the case of TB treatment: since untreated TB regularly results in death, and it is the already poor who are most likely not to seek or obtain treatment (either by choice or necessity), providing free treatment to them is unlikely to result in large distortions to their behavior. Even if it did — that is, even if the poor would prefer to spend the resources embodied in the delivery of free care in some other way — social preferences may not respect individual preferences in this case.¹²

In fact, available data show that the poor who suffer from TB spend a large amount of money on treatment, but with mixed results. This suggests added distributional benefits of public provision or subsidized and regulated private provision: if the quality of treatment increases and the poor do not have to pay, they win on both dimensions. Higher quality necessarily weakens the targeting properties of the scheme of course, but again, given the skewness of the distribution of TB incidence, such effects may not be too costly.

5. Conclusions

Private and public expenditures on tuberculosis control are significant, even amongst the poor. Some cost – effectiveness studies suggest that the resources currently being directed to TB control could, if redeployed in more efficient and effective programs, be sufficient to make significant progress in fighting the disease. There is therefore, at a societal level, a willingness to pay for improved tuberculosis outcomes. However, redeployment of resources is not an easy business. Transferring resources to the public sector is itself costly, and changing the behavior of providers and consumers can be difficult. Countries with existing public health infrastructure should consider expanding tuberculosis control services, while those with ineffective public systems should think seriously about fostering regulated private provision.

Whenever there is under-utilization of quality treatment due to market failures on the demand or supply side, it is *possible* to use public provision to improve matters. Public provision serves either to *supplement* private supply when there are consumption externalities, when providers exercise monopoly power, or in the case of public goods, or to *substitute* for private supply when providers use costly techniques or provide low quality services. There are however, alternative measures, ranging from information campaigns to price interventions, that should also be considered. An important reason for examining interventions other than direct public spending is that raising public funds itself is expensive: a rupiah spent by the government can represent a much larger cost imposed on society when the distortionary and administrative costs of tax collection are considered. On the other

¹² Thus tuberculosis care might be considered a merit good, deriving perhaps from a lack of information held by the poor about the effects of care.

hand, high distortionary costs of taxation are likely to be indicative of an under-developed system of public finance in general, in which case the feasibility of price interventions may be limited. A substantive choice then arises between investing in the capacity of governments to regulate private provision against investing in their capacity to provide a quality service directly.

The interventions considered in this paper have been primarily focused on detection and cure. Complementary to these curative responses, preventive actions are required if incidence of the disease is to be reduced over the long term. Improvements in housing and crowded transport and working conditions — i.e., general economic development — might be as important in controlling the spread of the disease as is the inducement of treatment completion and appropriate therapeutic actions.

Much of this paper has argued for public intervention on efficiency grounds, by identifying potential public goods attributes of TB control, externalities in its consumption, and supply side failures. However, it is important to recognize that tuberculosis control has the potential to serve the important cause of poverty reduction. While any specific intervention is likely to have a small effect on the poor in aggregate, improving TB services — that are disproportionately needed by the poor — would appear to be a reasonably safe redistributive bet.

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