images are acquired and transmitted one by one to the hub site. On the basis of an assessment in Oklahoma, 85% of needs can be met in near real time using such technology. Such systems are currently available in the United Kingdom, although uptake as yet has been poor.

To allow fast transmission of images the data for digital images must first be compressed. Generally, the greater the compression the faster the transmission but unfortunately the greater the risk of losing detail. Computed tomograms and magnetic resonance images are readily compressible because the images remain of diagnostic quality even when reconstructed with relatively low resolution. Standard plain film radiographs, however, can tolerate much less compression if they are to remain of diagnostic quality. Plain radiographs are now readily transmitted in the United States, but radiologists remain divided on whether the detail of the received image is of sufficient diagnostic quality. Currently, the high resolution required for mammography makes mammograms unsuitable for transmission.

The future

Teleradiology will develop rapidly in three key areas. Firstly, subspeciality consultation will develop on an established base. This will enable general radiologists to avail themselves of skills in specialties such as neuroradiology or paediatric radiology.[3 4]

Secondly, interactive ultrasound imaging will facilitate the performance of examinations in health centres, general practice surgeries, and satellite hospitals under the distant supervision of a consultant radiologist.

Finally, the role of inexpensive personal computer based systems in providing emergency radiology cover outside normal working hours is likely to expand. The temptation to provide an on call service from home to several hospital sites will become irresistible to increasingly financially competitive hospital trusts.

Teleradiology is already impinging on everyday practice, but rapid expansion, driven by an ongoing desire for increasing cost effectiveness, will be seen in the near future. It is no longer a fairytale dream but a useful tool to be used for greater benefit of patients.

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Smuggling and cross border shopping of tobacco in Europe

Luk Joossens, Martin Raw

Governments have recently become concerned about cross border shopping and smuggling because it can decrease tax revenue. The tobacco industry predicted that, with the removal of border controls in the European Union, price differences between neighbouring countries would lead to a diversion of tobacco trade, legally and illegally, to countries with cheaper cigarettes. According to them this diversion would be through increased cross border shopping for personal consumption or through increased smuggling of cheap cigarettes from countries with low tax to countries with high tax, where cigarettes are more expensive. These arguments have been used to urge governments not to increase tax on tobacco products. The evidence suggests, however, that cross border shopping is not yet a problem in Europe and that smuggling is not of cheap cigarettes to expensive countries. Instead, more expensive "international" brands are smuggled into northern Europe and sold illegally on the streets of the cheaper countries of southern Europe.

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In the past few years governments in many countries have become concerned about cross border shopping and smuggling because it can lead to loss of tax revenue. Until recently, increasing tobacco tax has always resulted in an increase in real terms of tax revenue in all European countries. The tobacco industry predicted that the removal of border controls within the European Union would change this and that price differences between neighbouring countries would lead to a diversion of tobacco trade, legally and illegally, to countries with cheaper cigarettes.[1] According to the industry, this diversion would be either through increased cross border shopping for personal consumption or through increased smuggling of cheap cigarettes from countries with lower tax to countries with high tax, where cigarettes are more expensive.

At first sight such claims might seem to reflect real concern for business from honest tax paying citizens. It is clear that governments are the main losers—of tax revenue. But it is interesting to look at who might benefit from cross border shopping and smuggling. If it results in pressure to keep down tax it could result in increased sales and profits, in which case the beneficiary is the tobacco industry, especially the manufacturers. No surprise then to find the tobacco industry making vociferous claims about the dire effects of cross border shopping and smuggling and arguing strenuously that tobacco tax should be lowered. Are their claims justified?

Cross border shopping

Since the opening of the European single market in January 1993 consumers have been allowed to buy almost unlimited quantities of tobacco for their own use (with suggested "indicative" levels, below which use is assumed to be personal but above which personal use must be proved, of 800 cigarettes, 1 kg fine cut tobacco, 400 cigarillos, and 200 cigars). Belgians, French, and Germans have traditionally stocked up on cigarettes when passing through Luxembourg because of the low price of cigarettes there. It can be estimated that only 15% of tobacco bought in Luxembourg is consumed there. In 1993 cigarette sales in the European Union totalled 559 billion or 1610 per person.[2] At this average European consumption, Luxembourg (population 395 000) should have smoked 636 million cigarettes rather than the 4188 million actually sold there. The 85% difference is assumed to be due to cross border sales.

However, since the opening of its borders in January 1993 there has been a small decline in cigarette sales in Luxembourg: 4162 million cigarettes were sold in Luxembourg in 1992, 4188 million were sold in 1993, and 4106 million were sold in 1994 (Ministry of

Finance, Brussels, personal communication). Thus, the predicted increase in cross border shopping in Luxembourg has simply not materialised since border controls were relaxed.

A British study by the Centre for Health Economics at York found that there is little incentive for cross border shopping[3]: the savings on 800 cigarettes bought in France and taken back to Britain would be outweighed by the costs of the trip (800 cigarettes bought in France would save about £30, much less than the cheapest fares, and this is without costing the time taken). Cigarettes bought during a trip for other reasons would obviously not incur extra costs. However, the proportion of travellers who buy tobacco does not seem to be high, and those that do generally buy small quantities: in one study the average quantity was 300 cigarettes per purchaser and only 20 cigarettes and 2 g of loose tobacco per traveller.[4]

Even the British tobacco industry acknowledged in their November 1994 budget submission that cross border shopping accounts for only about 0.5% of the British cigarette market.[5] The York study included government data on consumer expenditure on tobacco from 1986 to 1993, and the data did not show the predicted fall in Britain in the first year of the single market. There is thus no evidence yet that cross border shopping is an important problem in Europe. It could become a problem if there were large price differences for the same brand of cigarette in neighbouring countries. This is not so for cigarettes but is a problem for hand rolling tobacco (a relatively small sector of the industry): the leading British brand costs 2.5 times as much in Britain as in France.[6]

Smuggling

HOW BIG IS THE PROBLEM?

The overall size of cigarette smuggling can be estimated from the gap between global exports and global imports, as most of the "missing cigarettes" are smuggled. World cigarette production is known fairly accurately, and, since there are not large numbers of cigarettes in storage because they do not keep for long, world production is very close to world consumption. Global imports should thus be close to exports, after allowing for legitimate trade usually excluded from national statistics. (These are principally imports for duty free sales to travellers, diplomatic staff, and military establishments.)

Imports, however, have long been lower than exports to an extent that cannot be explained by legitimate duty free sales. Although the volume of duty free trade is not on public record, it has been estimated with some confidence by the tobacco trade at about 45 000 million cigarettes a year.[7] Even the time lag of three to six months between recording export and import statistics cannot explain the differences between import and exports, which have been high for years (fig 1). In 1994, 910 000 million cigarettes were exported but only 586 000 million were imported, a difference of 324 000 million. After deducting 45 000 million for legitimate duty free sales, there are still almost 280 000 million missing cigarettes. The only plausible explanation for these missing cigarettes is smuggling.[8 9] At a conservatively estimated average duty of US$1 (66 pence) per cigarette pack (this is much higher in most developed countries), smuggling accounts for more than $16 200 million being lost annually by governments.

THE CANADIAN STORY

The tobacco industry has claimed that the Canadian experience shows what happens when cigarette prices differ too much between neighbouring countries and has argued that tobacco taxation should therefore be lowered. This is what eventually happened in Canada, with disastrous results. It is therefore important to learn from the Canadian experience in order to prevent it happening again.

During the 1980s Canada had a tobacco control policy that included progressive price increases, with the result that by the early 1990s a pack of 20 Canadian cigarettes cost about US$4·7. Canadian policies were extremely successful in reducing consumption, resulting in a fall in per capita adult consumption (total consumption from all sources including smuggled cigarettes) of almost 40% from 1982 to 1991.[11] However, the United States has one of the lowest levels of tax on cigarettes in the developed world (about 50 cents per pack in 1994). Consequently, the price difference between Canadian and American cigarettes became the largest in the world: by 1991 the prices were about $4·7 and $1·7 respectively, an almost threefold difference. The result was a massive increase in smuggling, from an estimated 1270 million cigarettes in 1990 to 14 210 million in 1993.[11] The Canadian tobacco industry lobbied fiercely for a reduction in tax, which they suggested was the only real solution to the problem. There was concern about loss of government revenue and loss of business in Canada. For a variety of political reasons the Canadian government gave in to industry pressure and lowered taxes, resulting in a rise in per capita consumption of 7% from 1993 to 1994 and of 9% in the overall market.[12] However, the situation was not a simple as it might seem.

Americans and Canadians do not smoke the same brands. There would thus be little demand in the United States for Canadian brands. In the mid-1980s exports represented less than 3% of total Canadian cigarette shipments, but by the end of 1993 exports represented more than 37% of total shipments, most of them to the United States.[11] Cigarettes made in Canada were being exported to a country with no market for them. The cigarettes were in fact exported to American warehouses, from which they were smuggled back across the border to undercut higher Canadian prices. Since about 90% of the cigarettes smuggled into Canada were probably manufactured by the Canadian tobacco industry (since Canadian smokers like Canadian brands), the industry could hardly complain that this was damaging production and jobs in Canada. On the contrary, since these cigarettes were much cheaper than those sold legally, the whole enterprise was stimulating demand and thus production, to the benefit of the industry.

In response to fierce lobbying by the industry the Canadian government dramatically reduced tobacco tax in February 1994. The reasons for this were complex and included political calculations in the light of an impending election, but it had several undesired consequences, possibly the most serious being an increase in consumption. It is too early to see the full

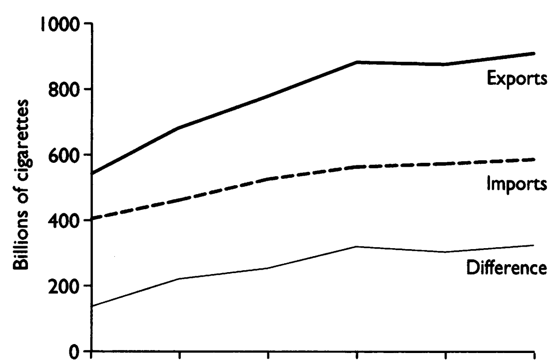

FIG 1—*Global exports and imports of cigarettes (data from United States Department of Agriculture[10])*

effects of the price reduction, but there is already a detectable increase in smoking among 15-19 year olds.[12] The Non Smokers' Rights Association estimate that there will be a 50% increase in teenage tobacco consumption and an eventual increase throughout Canada of 250 000 deaths as a result of the fall in price.[11] The move also caused loss of revenue.

SMUGGLING IN EUROPE

The Canadian experience has been cited as an example of what will happen in Europe because of price differences between states and the removal of border controls. But the situation in Europe is completely different. Firstly, the United States has exceptionally low tobacco tax over which Canada has no control. Secondly, the border between Canada and the United States is the longest undefended land border in the world, and most Canadians live within two hours drive of it. It is effectively an open border. Furthermore, it is especially open to cross border traffic in certain areas like the Akwesasne Indian Reservation, which lies partly in New York State and partly in Ontario and Quebec. When New York first sought the authority to control the amount of cigarettes shipped into Indian reservations they became tied up in legal procedures, though the United States supreme court did give the state the right to control these shipments in a decision handed down in mid-1994.

It is important to reiterate that, in general, preferences for cigarette brands are nationally determined.

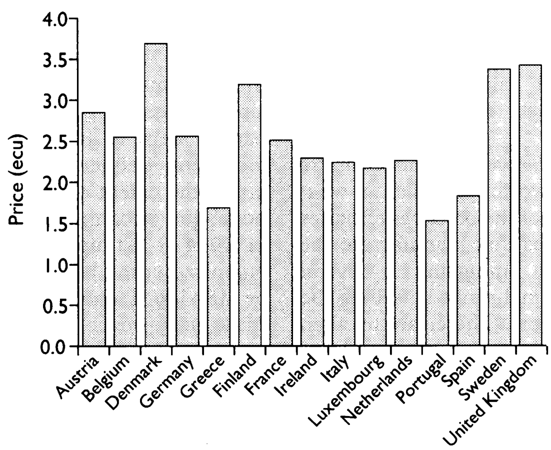

FIG 2—*Prices of a packet of 20 Marlboro cigarettes in the 15 member states of European Union in 1995 (data from European Bureau for Action on Smoking Prevention[13])*

FIG 3—*Key places for tobacco smuggling and cross border shopping in Europe*

Although the most popular brand in Spain (Ducados) is a fifth of the price of the most popular Danish brand (Prince) (0·76 European currency units (ecu) (68 pence) *v* 3·80 ecu (£3.10) in January 1995), the Danish market is not flooded with cheap Spanish cigarettes. The price differences between national brands is less important than price differences of well known international brands (fig 2), which smugglers prefer because they can sell them almost anywhere.

The largest difference—between 20 Marlboro in Denmark and Portugal—is 240%, but the differences between neighbouring countries are much smaller. For example, 20 Marlboro cost about 3·42 ecu in Britain, 2·56 ecu in Germany, 2·55 ecu in Belgium, and 2·51 ecu in France. These differences are not great enough to pay for intermediaries and transport while still offering sufficient price reduction to tempt consumers to buy black market cigarettes. Nor do they allow enough in reserve to pay for fines when contraband cargoes are discovered through customs operations. Duty free (tax unpaid) cigarettes are another matter. Even in European countries where cigarettes are cheap, tax still accounts for about 70% of the retail price of the cigarettes. For smugglers there is no point in buying an international brand of cigarette in Portugal for 1·53 ecu a packet after tax if it can be bought from the American manufacturer untaxed at 0.30 ecu. This is the smuggling market in Europe—not the movement of cigarettes from the cheaper south to the more expensive north but the (illegal) movement of duty free imported international brands from northern ports to the south and increasingly to the east. In Spain and Italy the black market is made up essentially of smuggled American cigarettes.

SMUGGLING ROUTES

There are two systems of transit procedure for controlling transport and tax payment in the European Union. The first is the union's own system, designed to supervise the movement of cigarettes around the union and countries of the European Free Trade Association. Thus cigarettes arriving in Belgium but destined for Italy would be liable for duty in Italy and not Belgium. The second is the international Transport Internationale par Route (TIR) system, which would be concerned with the transport of cigarettes outside the union (for example, to Eastern Europe). In either case what happens is in principle the same. The cigarettes are exported from the United States to northern European ports such as Antwerp, Rotterdam, and Hamburg. No tax is paid at the port if the cigarettes are destined for another country. This is proved by the presentation of completed transit documents which show that the cigarettes have arrived in the other country.

There are two principal options for smugglers at this point. Firstly, the documents may be forged to state that the goods have arrived in the other country when they have not, with or without the help of officials. The cigarettes themselves are switched from one lorry to another during the journey. Secondly, the cigarettes may actually be exported outside the European Union and then smuggled back, often by speedboat. Known transit points for this include Andorra, Cyprus, Gibraltar, and several eastern European countries (fig 3).[14] Domestic cigarette consumption in Cyprus is about 1300 million a year,[15] but in 1992 about 35 000 million cigarettes were exported from Belgium to Cyprus.[16] Antwerp in Belgium is an ideal port for cigarette imports because of its huge storage areas. In 1993, 53 000 million American cigarettes were imported to the European Union, 51 000 million of them to Belgium.[17]

The customs and transit arrangements, particularly the Transport Internationale par Route convention, have made this fraud easier. This convention was designed to promote international trade by road with the minimum of bureaucracy. Its purpose was that goods could arrive in (say) Antwerp and be checked by customs officials, who would issue documentation and seal the lorry. The lorry would not be unsealed until it arrived at its destination, where customs officials would inspect the goods to check that they were all there and then issue a transit document certifying the fact. This document would be returned to the customs office from which the goods departed. At borders drivers would have to present only their Transport Internationale par Route documents. The system is underwritten by guarantees from the trucking companies, underwritten by their insurers, and administered by the International Road Transport Union. If something goes wrong (a lorry load of cigarettes disappears or the documents are found to be forged) the culprits (if they are identified), the trucking company, or, failing these, the International Road Transport Union forfeits the guarantee of about \$200 000. In December 1994 the cost of the alcohol and tobacco fraud had become so great that the International Road Transport Union withdrew from the system and stopped issuing Transport Internationale par Route certificates for alcohol and tobacco. Their insurance companies had announced that they would no longer cover them because of the huge risk of fraud. The trucking companies were left to fend for themselves.[18]

There is no evidence that this smuggling is caused by high prices and differences within the union. In the country with the highest price, Denmark, there is little evidence of smuggling, while in Spain, where prices are much lower, the illegal sale of international cigarette brands on the streets is widespread and accepted.

Given the size of the gap between world cigarette exports and imports, it is worth speculating what might be the attitude and role of the chief beneficiaries of this illegal trade—companies that manufacture the cigarettes. They benefit from smuggling in several ways. First they gain their normal profit by selling the cigarettes (legally) to distributors. The cigarettes then find their way on to the black market to be sold at greatly reduced prices, stimulating demand. This puts pressure on governments not to increase tax because of the loss of revenue, which may also result in lower prices and higher consumption. The industry uses this to urge governments to reduce or not to increase taxes. Finally, contraband cigarettes that are intercepted by customs have then to be replaced—yet more sales.

Solutions

The Canadian experience serves as a warning that the problem cannot be solved by lowering taxes. The results in Canada have been disastrous, especially for health. Europe is different in a crucial respect. The European Union is gradually moving towards a single market with harmonised tax rates. This will take time to achieve, with distortions in the market remaining so long as there are large differences between countries in taxes and prices. Thus price differences in the community will eventually disappear. However, they are only an excuse for the industry to push for tax reductions (or to restrain increases). An equally logical solution would be to increase taxation as rapidly as possible in countries with low taxes, not a solution proposed by the tobacco industry. But this is the solution essential to protect the health of the union's 370 million citizens.

The heart of the tobacco smuggling problem in Europe is crime, and this will have to be solved by changing attitudes and better law enforcement. Changing attitudes may be the most difficult to achieve. In Italy tobacconists are being encouraged to display a sign informing smokers of the health risks they may be running by smoking smuggled tobacco because of the insanitary storage conditions of smuggled goods. However, such an approach may not have much impact if some cachet is attached to flouting authority, and consumers tend to vote with their pockets. Clamping down on the outlets for smuggled cigarettes, which in some southern states are almost part of the culture, would require not only better law enforcement but also a considerable change in smokers' attitude towards authority. Restricting sales of cigarettes to licensed premises and heavy fines for unlicensed vendors would help, and they have had a measurable impact in Spain. In 1993 sales of premium Virginia cigarette brands by Tabacalera, the state monopoly, fell by almost 21%, but after the introduction of special stickers to show that tax has been paid and tougher penalties for bars and cafes caught selling contraband cigarettes sales have recovered sharply.[14]

An approach that combines reducing demand and controlling supply is the use of prominent tax stamps on cigarette packs to show that they are legally imported and have had duty paid. The absence of a stamp would immediately show consumers, legitimate retailers, and the authorities that the cigarettes were being sold illegally. Most countries in the European Union use tax stamps, but they are often not conspicuous enough to be of any use.

The reduction of supply is probably most important. This will require more cooperation between customs officials in Europe and between European officials and their counterparts in the United States. There is already increasing cooperation in Europe, and newspapers seem to be reporting customs seizures with increasing frequency. The European Union, recognising the extent of the problem, has investigated the possibility of computerising transit arrangements, and in 1994 it set up a tobacco task force to combat organised crime but recognised that solutions cannot be developed only in Europe: "The comprehensive strategic approach is more effective than a country-by-country case-by-case approach."[19] As with illegal drugs (which tobacco increasingly seems to resemble from a control point of view), we believe it is time for an international convention to control the transport of cigarettes, not only by road but by any means of transport. In view of the involvement of organised crime, this convention would need the support of governments throughout the world and of some central organisation.

Cooperation between the European Union and the United States is also important, and the Canadian story suggests that the tobacco industry should be asked to cooperate in ensuring its products are as well protected against theft and fraud as they can be. What happened in Canada suggests that the industry may be indifferent to the illegal trade in tobacco. If they wish to persuade us that they respect the right of governments to determine tax policy they will have to take measures to support government efforts to prevent smuggling.

We thank David Sweanor and Christine Godfrey for comments on a draft of this paper.

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South Africa's Health

Restructuring South Africa's health care: dilemmas for planners

Rajendra Kale

This is the last in a series of articles reporting on health care in South Africa

Restructuring South Africa's health care involves providing care to the majority who have so far been deprived of it without destroying the excellent tertiary health care facilities and the high standards of academic medicine that exist in the country. South Africa spends 6·4% of its gross domestic product on health, which is more than the goal—5% by the year 2000—set by the World Health Organisation. But 46% of this amount is spent on the private sector, which serves 19% of the population, as was explained by Dr Nkosazana Zuma, South Africa's health minister, in her health budget speech to the parliament on 20 October 1994. Moreover, 75% of the health budget, which was 14 billion Rand for 1994-5, is spent on hospitals and academic institutions. In effect, the amount spent on health care for most of the population is much less than the 5% recommended by the World Health Organisation.

Dr Zuma said in her speech that the cornerstone on which the future health care system will be built would be a district health system offering a package of primary health care provided by a district health authority. She clarified that primary health care was not synonymous with preventive health care and that the proposed system would achieve a balance between promotion, prevention, rehabilitation, and curative services. She also outlined definite goals that the government was committed to achieve: these focused on the control of infectious diseases, an obvious priority for any developing country (box).

Goals set by the health minister

- Increase the coverage of immunisation for each vaccine for children to 90% (from the present 70%) by the year 2000
- Eradicate poliomyelitis by the year 2000
- Reduce neonatal tetanus to fewer than one case per 100 000 live births in all districts by 1997
- Reduce the number of patients with measles to fewer than 4000 cases for five years beginning in 1996.

Budget cuts for academic institutions

Finding the money for primary health care is difficult. Much of it will have to come from the academic institutions. Dr Zuma said that the government and the deans of the academic institutions had agreed to cut their expenditure by 5%.

Academic institutions and the big hospitals have been subjected to budget cuts in the recent past, and this further cut is not welcome. Ralph Kirsch, profesor of medicine in the University of Cape Town Medical School, said: "Some of us in the larger hospitals will suffer and there is a danger that we may get destroyed. While redistributing resources we would like the money for primary care to come from another source than ourselves, but it is coming from us.

"A hospital like Groote Schuur sees about 1·2 million patient visits, of which 80% are for primary care. We support the minister where primary care is concerned but not at the cost of destroying this. If this is destroyed, the future of medicine is destroyed. We train health care workers. Nothing has got worse so far, but the potential exists."

One possibility that is being considered is closing one or two medical schools instead of cutting the budgets of all schools.[1] Dr J P deV van Niekerk, dean of the University of Cape Town Medical School, said, "There is a threat to the educational institutions as funds may be diverted from medical colleges to finance primary health care. The important question is, can we afford to have eight medical schools, which means a medical school for every five million people. Is this number appropriate for our economy? Some feel that these are too many. On the other hand, the population is increasing rapidly and it takes 10 years to start a medical school. If you drop one medical school now, you are going to need one in the following 10 years. The danger is that the medical schools could have severe damage done to them. As medical schools generate the personnel needed for primary care, taking funds away from them is seen as a serious threat by me and my colleagues."

Dr William Pick, professor of community medicine at the University of Witwatersrand, was not perturbed by any proposed cuts: "A 5% cut in the budget of academic institutions really means that we need to improve our management, work efficiently, and save 5%."

Dr Zuma enumerated in her speech some ways in which the financial problems could be overcome but was short on detail. She hinted that doctors were not the best financial managers for a hospital but did not propose any specific alternatives. She suggested using appropriate personnel for health care, such

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