2. Commentary

In 2006, 422,830 tuberculosis (TB) cases were reported by 51 of the 53 countries of the WHO European Region (no data from Monaco and San Marino; Tables 1, 2), representing 7% of TB cases reported to WHO worldwide in the same year [1]. Seventy-three percent of all TB notifications in the Region were reported from the East, 21% from the European Union & West and 6% from the remaining countries in the Balkans (Map 1).

The incidence of TB (overall notification rate 48/100,000) increased progressively when moving from West to East, mirroring also the geographical gradient in TB mortality (Maps 2, 3). Total notification rates (new and previously treated cases) have continued to diverge between the West and East in recent years (Figure 1).

2.1 European Union and West (EU & West)

TB case notification

In 2006, of the 89,032 TB cases reported by the 32 EU & West countries sending data (Table 2), over two-thirds occurred in the six countries which reported more than 5,000 cases each (France, Germany, Poland, Romania, Spain, and United Kingdom). The overall notification rate was 17/100,000, with rates lower than 10/100,000 in 15 countries and higher than 25/100,000 in Romania (127), the Baltic States - Lithuania (75), Latvia (58), Estonia (34) – Bulgaria (42), and Portugal (32). The overall rate in the 12 countries joining the EU since 2004 was over 4 times higher than in the 15 original member states. Despite the increased burden, the overall notification rate in the EU & West in 2006 was 15% lower than that in 2002, reflecting a net downward trend in 21 countries. Overall, the average annual decrease in rates between 2002 and 2006 was larger than that observed between 1998 and 2002 (mean -4.0% versus -1.3% respectively). Nearly all countries experienced a decline in notification rates or stabilisation at low levels in paediatric cases (under 15 years) in recent years suggesting decreasing or low levels of transmission in the general population (Country Profiles). In Bulgaria, Latvia, Lithuania and Romania, however, rates in children are high (19-32/100,000). In Ireland and Italy, an increase in rates in young adults in recent years was compensated by a decrease in the elderly resulting in stabilisation overall. A decrease in the elderly in Norway was accompanied by increases in all other age groups leading to a net increase in rates. Greece, Sweden, and the United Kingdom experienced increases in all age-groups between 2002 and 2006, with a levelling off in the latter years in Greece and Sweden. In Greece, this may be a result of more complete reporting. In Sweden, increases occurred among both native and foreign-born cases until 2005, while in the United Kingdom the increase was largely restricted to foreign-born cases. In Western Europe, TB case rates in the population of foreign origin were much higher than in nationals reflecting a greater predisposition of this sub-population to develop TB (57 vs. 5/100,000 in 13 countries in 2004) [2].

Males predominate among TB cases in nearly all countries, and this feature is more marked among nationals than among cases of foreign origin (overall M:F ratio 1.9 in nationals versus 1.3 in foreign cases, Table 3). This difference remains significant even when excluding Romania. Total M:F ratios were generally lower in countries with < 10 cases/100,000 than those with > 25/100,000 (median: 1.4 vs. 2.2 respectively).

Paediatric cases represented 4% of notifications, in both cases of national and foreign origin (Tables 4, 5). In contrast, the middle-aged (45-64 years) and the elderly (>64 years) together represented more than half the national cases, but only 27% of foreign cases. Most cases of foreign origin were concentrated among younger adults, especially in the 25-34 year age-group (32%). In 29 countries with case-based information, the median age of cases in 2006 was much higher in nationals than in cases of foreign origin (47 and 34 years respectively overall).

In 2006, 20% of TB cases reported were of foreign origin. This proportion was much higher when excluding Bulgaria and Romania (31%), and it ranged from 40 to 100% in 16 countries (Map 4). Overall, 35% of cases of foreign origin were from Asia, 32% from Africa, 20% from another country of the EU & West or Balkans and 7% from Former Soviet Union (FSU) countries other than the Baltic States (data from 27 countries, no cases in Romania; Table 6). Between 2000 and 2006, notifications among nationals decreased in nearly all countries but increased in cases of foreign origin up to 2005 and then decreased in 2006 (Table 7, Figure 2). A sharp drop in foreign cases was observed in Austria, Denmark and Sweden between 2005 and 2006 after an increase in previous years, while a steadier decline occurred since at least 2003 in France, Germany, Israel, The Netherlands, Portugal and Switzerland. Cases in foreigners increased progressively and substantially in Italy and the United Kingdom since at least 2002.

Pulmonary TB was reported in 80% of cases and 20% had exclusive extra-pulmonary disease (Table 8). Mixed sites were present in 5% so that 22% of all TB cases in 27 countries with data had an extra-pulmonary localisation, with a wide range between countries reflecting differences in reporting practices and the ethnic profile of cases. The proportion of pulmonary TB has decreased in the United Kingdom (Table 9), concurrent with recent increments in imported TB cases. In Italy, the proportion of native and foreign-born cases with pulmonary TB decreased, as well as the absolute number of pulmonary cases among natives. A slight increase was also noted in the Baltic States since 2002. Severe forms of extra-pulmonary TB accounted for only 2% of all TB cases reported (range: 0-6% in 22 countries with data, Table 10). Most cases were reported in indigenous adults. In 2002-2006, the rate of TB meningitis in children under 5 years remained < 1.0/10 million general population in most of these countries (Table 11). Rates ≥1.0 on two years or more were reported by Belgium and Ireland (total TB case rates 11/100,000 in 2006), as well as Lithuania, Portugal and Romania (total TB rates >30).

Sputum smear positive rates were lower than 5 cases /100,000 in 21 countries in the last three years (Table 12). They were consistently higher than 10.0 in the Baltic States, Portugal and Romania. Where rates were < 2 cases /100,000, the proportion of pulmonary cases with positive sputum smear was < 45% (except Iceland 2006) suggesting under-reporting. Sputum smear positive rates increased slightly in Italy and Poland in 2004-2006, in parallel with the proportion of pulmonary TB cases reported as sputum smear positive.

In 2006, 80% of the cases had not previously received anti-TB treatment, with wide variation between countries (Table 13, Map 5). This proportion has not changed markedly in the past years but the total number of new cases has decreased progressively and is the main reason for the decline of TB in the EU & West (Figure 1). Wide fluctuations in the proportion of previously-treated cases may result from changes in definition or in patient access (e.g. Estonia, Romania).

When excluding Romania (incomplete results at time of reporting), 56% of cases reported in 2006 were culture-confirmed, but the level differed widely across countries (range: 31-100%, Table 14, Map 6). The overall proportion has remained quite steady in 2003-2006 but substantial improvement in culture confirmation has occurred in France and Lithuania. It has been high - 75% or more – throughout the period in Belgium, Denmark, Estonia, Finland, Luxembourg, Slovenia, Sweden, Norway and Switzerland. Species identification showed *M. tuberculosis* in 93.6% of culture positive cases in 2006 (25 countries, Table 15). *M. bovis* (0.5%) was reported by 12 countries and *M. africanum* (0.3%) by 7 countries. Most *M. bovis* cases (84/124) were indigenous, while half of the *M. africanum* cases were African.

In 14 countries reporting individual data, most or all of the cases satisfied the clinical criteria in terms of the revised European TB case definition (data for the United Kingdom refer only to Scotland, where 384/385 cases met the criteria, Table 16). Diagnosis was made post-mortem in 0-4% of cases. Four countries provided results of histology testing, five for nucleic acid testing and another four for both, with varying completeness. In no country did additional testing increase the fraction of confirmed cases as determined by culture alone (except Germany, 1% more). It did however increase the proportion of cases with laboratory criteria for 'probable' - by up to 8% in some countries - than would have been possible based solely on a positive sputum smear.

Tuberculosis and HIV infection

Aggregated data on HIV sero-status of TB cases reported in 2003 or later were available for 23 countries (Table 17). Completeness of information varied widely due to differences in testing policies and in data collection (only HIV-positive results being reported in some countries). The proportion of TB cases with positive HIV sero-status (for the latest available year 2003-2006) was highest in Iceland (15%, 2 cases) and Portugal (14%), was 2-9% in 12 countries and 0-1% in 9 countries. This proportion increased since 2000 in Estonia (from 0.1% to 9.0%) and Latvia (from 0.7% to 3.4%), both countries which experienced a sharp increase in HIV infection in the early years of this decade **[3]**. In England & Wales, the number of HIV/TB cases and the proportion of TB cases with HIV increased steadily between 2000 and 2003, reflecting trends among recent immigrants from various countries to the United Kingdom **[4]**. In Spain, in contrast, the number of new HIV/TB cases has reportedly decreased since 2002.

TB was initial AIDS-indicative disease in 1,742 (21%) of 8,170 AIDS cases reported in 2006 (33 countries, Table 18). No data on AIDS-indicative TB were available in the Netherlands, Norway and Romania. AIDS cases with TB as initial AIDS-indicative disease represented 2.9% of all TB cases notified in 2006, but countries with some of the highest estimated HIV

prevalence among adults had higher proportions - Portugal (9%), Spain (7%), and Switzerland (5%) **[5]**. When adjusted for reporting delays, annual numbers of AIDS cases with TB as initial AIDS-indicative disease decreased by about 40% overall between 2000 and 2006 (26 countries with data, Table 19).

Anti-tuberculosis drug resistance

Data on anti-TB drug resistance surveillance (DRS) in 2006 were made available by 30 countries, and by Poland and Romania for 2003-2004 (Table 20).

Among 24 countries having more than one laboratory performing drug susceptibility testing (DST), national external quality assurance schemes existed in 15 (Table 21). Apart from Bulgaria, Greece and Luxembourg, all national reference laboratories (NRL) had participated in international quality assurance for DST since 2003. Concordance with the supranational laboratories was 100% for both isoniazid and rifampicin in 17 countries, and 90-98% for one or both drugs in seven countries.

Data from 21 countries performing culture and DST routinely in 2006, and providing DST results as part of a national case-linked dataset, were considered representative (Table 22). Nationwide aggregated data from France and Israel were also included with this group. DST data from another seven countries were considered non-representative. Three of these countries reported DST results in case-based format but the use of culture and/or DST was not routine or results incomplete. Cases resistant to one or more first-line anti-TB drug were reported by all countries except Andorra and Luxembourg. The Baltic States, Bulgaria, Germany, Spain and the United Kingdom had 50 or more multidrug resistant (MDR) cases (Table 23). The proportion of new cases with MDR ranged from 0-7% (Table 24, Map 7), but was higher in Malta (14%, 2 cases) and in the Baltic States (9-13%). Drug resistance was commonly higher in cases of foreign origin compared to nationals (Tables 25, 26, Country Profiles). Between 2001 and 2006, the proportion of foreign-born cases with MDR in Israel was highest in 2006 (8.0%), while in Austria it peaked in 2004 (7.8%, Table 27). The proportion of combined MDR cases decreased in Estonia (since 2001), Latvia (2004-2006, not significantly) and Lithuania (2003-2006), but these trends were not significant for primary MDR cases. This suggests that retreated cases are decreasing faster than incident ones in these countries.

Treatment outcome

Twenty-five countries reported treatment outcome monitoring data for definite pulmonary TB cases in 2005 (Table 28). Complete cohorts of pulmonary culture positive cases were available in all countries except Bulgaria (smear or culture) and Italy (incomplete national coverage, smear or culture). These two countries, as well as Israel, did not report outcomes in case-linked format.

Among previously untreated cases (Table 29), 79% had a successful outcome, 6% died, 4% failed or continued treatment beyond 12 months and 10% were lost to follow up (defaulted, transferred or no known outcome). Among countries with > 20 new cases, success ratios ranged very widely from 50% in Hungary to 90% in Norway and Slovakia. Seven countries (two with < 10 new cases) achieved 85% success or more. Success ratios < 75% were associated with high loss to follow-up (10-35%). In Estonia and Lithuania this was also associated with protracted treatment necessary for a larger case-load of drug-resistant cases. A reduction in cases lost to follow up has led to improvements in success ratios over time, particularly in countries like Portugal and Romania (Figure 3, Country Profiles).

Among previously treated cases (Table 30), the overall success ratio was lower than among new cases (51%; range: 28-93%). Death (10%) and failure or still on treatment (18%) were more frequently reported than among new cases, due to the higher prevalence of drug resistance in this group and to the longer duration of re-treatment regimens. High proportions of loss to follow up (21%) also lowered success ratios.

In the 23 countries reporting comprehensive case-linked data, success was marginally higher in nationals than in cases of foreign origin (74% versus 72%, Table 31), but also deaths (7% versus 5%). In contrast, nationals were less likely to be lost to follow up (12% versus 19%). Cases with pulmonary TB were less likely to succeed treatment and more likely to die than extra-pulmonary cases (74% and 7% versus 81% and 4% respectively, Table 32). This attests to the more serious nature of pulmonary disease, with serious forms of extra-pulmonary disease being rare in the EU & West (see above).

2.2 Balkans

TB case notification

In 2006 TB patients from Turkey accounted for 76% of the 26,911 cases[1] reported by the seven Balkan countries (Table 2). The overall TB notification rate was 28/100,000, with rates higher in Bosnia & Herzegovina (46) than in the other countries (16-31).

[1] Not including 1,122 cases from Kosovo (rate ca. 53/100,000)

Between 2002 and 2006, rates decreased by 4-11% yearly in all countries except Turkey, where a stabilisation in rates – as well as an increase in sputum smear-positive rates since 2005 - followed efforts at improving case detection. In 2006 and before, age-specific notification rates increased progressively from childhood to old age in all countries (excluding elderly in Montenegro in 2006). Over the last few years, rates have been low and stable in children and decreasing in most age-groups in Albania (elderly excluded), Bosnia & Herzegovina, Croatia and Serbia (Country Profiles). In Macedonia F.Y.R., rates are high in children but decreasing or fluctuating in adults.

Only 1% of cases overall were of foreign origin (10% in Croatia), half being from another Balkan country (Tables 3, 6). Two-thirds of total notifications were males. Paediatric cases represented 5% of reported cases in 2006 but reached 13% in Macedonia F.Y.R., suggesting over-notification in children in this country (Table 4).

Pulmonary cases represented 75% of notifications (range: 64-89%), including also cases with mixed disease (3% overall, excluding Montenegro, Tables 8, 9). The proportion of cases with an extra-pulmonary site has been high in Albania (36% in 2006) and Turkey (31%, of which 3% mixed). TB meningitis or disseminated TB represented 0.5% of all TB cases and no paediatric cases of meningitis were reported in 2006 in 5 countries with individual data (Tables 10, 11). More than half of the pulmonary TB cases were smear positive, with an overall rate of smear-positive TB cases of 12.2/100,000 population (Table 12). In none of the countries were rates lower than 5.0/100,000 in recent years although both smear positive cases and rates have decreased progressively in Albania, Bosnia & Herzegovina and Macedonia F.Y.R. since 2004, as well as rates in Croatia.

Only 10% of cases reported in 2006 had been previously treated (range: 6-16%, Table 13). All countries reported culture results in 2006, in contrast to only four in 2003. The proportion of cases confirmed by culture increased since 2005 in all countries except Albania (mean: 38% in 2006, range 33-70%, Table 14). In 3 countries with data, 31% of cases could be classified as confirmed, 16% probable, 40% possible and 7% confirmed only by laboratory as per the new European case definition (Table 16).

Tuberculosis and HIV infection

HIV sero-prevalence among TB cases was reported by four countries and was low (range: 0.0-0.6%, Table 17). While HIV patients may be subject to under-notification (Table 1), this finding is in keeping with the low HIV prevalence and AIDS incidence observed in the general population and in injecting drug users in particular in the Balkan sub-region **[3, 5]**. Among the 141 AIDS cases notified, 34 (24%) had TB as first AIDS indicative disease (Table 18). These represented 0.1% of all TB notifications made by the 7 countries. Total numbers of AIDS cases with initial TB showed no particular trends between 2000 and 2006 (Table 19).

Anti-tuberculosis drug resistance

All countries reported DRS data for 2006, five of which participated in international EQA for DST (Table 20, 21). Case-linked data on DST results were provided by all countries except Montenegro (in this report aggregate data for Bosnia & Herzegovina were used being more complete than case-linked data). Four countries reported no primary MDR cases. Three had complete, nationwide data and reported combined MDR in 0.4-1.9%, while in the other countries combined MDR was higher in Macedonia F.Y.R. and Turkey (3.7% and 5.1% respectively, Table 23). The increase in MDR cases and MDR prevalence in Bosnia & Herzegovina between 2001 and 2005 (from 2 to 11 cases yearly, 0.2% to 1.0%, Table 27) was followed by a decrease in 2006.

Treatment outcome

Outcomes for definite pulmonary TB cases notified in 2005 were reported by all countries, with Croatia and Montenegro providing incomplete data (Table 28). In countries with complete data, success ratios for new definite pulmonary cases averaged 89% (range: 79-97%, Table 29). Deaths were reported in 3% of cases and loss to follow up in 6%. Since 2002, the success ratio has remained stable among new cases in Bosnia & Herzegovina and Macedonia F.Y.R, and improved in Turkey (Country Profiles). Success among retreated cases in 2005 was 72% (range: 70-92%) while deaths (5%) and loss to follow-up (13%) were higher than in new cases (Table 30).

2.3 East

TB case notification

In 2006, the overall TB notification rate in the 12 former Soviet Union countries in the East was 110/100,000 (306,887 cases, Table 2). Rates were higher than the mean in Kazakhstan (282), Moldova (160), Georgia (142) and Kyrgyzstan (127). Half of the cases in the East were reported by the Russian Federation, the only European country on the WHO list of 22 high TB-burden countries in the world **[1]**.

Notification rates increased on average by 3.2% yearly between 2002 and 2006, but this ranged widely between countries (-8% to +13%). It was much lower than that observed between 1998 and 2002 (5.8%). The overall increase was largely attributed to increasing inclusion of previously treated cases (Figure 1), as the number of new cases has been stable and, in 9 countries, actually decreased between 2005 and 2006. In the last 5 years annual increases in excess of 10% were reported by countries where TB control programmes have recently expanded and may therefore be explained by increased detection and patient access to care rather than a true increase in incidence. TB surveillance data and trends in the East have to be interpreted with caution, as in several countries TB notification has been variably affected by global changes in health and in TB control systems since the early 1990s. TB cases diagnosed in specific population groups (e.g. prisoners in the Russian Federation since 1998), and retreated cases other than relapses (e.g. Uzbekistan since 2002) were increasingly included in TB statistics.

In 2006 the male-to-female ratio of cases was 1.4 to 2.0 in the five central Asian republics, and 2.4 to 4.0 in the other countries (Table 3). This wide variation suggests sex-related differences in TB transmission, care and reporting between countries. Nearly all cases reported in the East were autochthonous and only Moldova and the Russian Federation reported foreign citizens, which however represented less than 1% of notified cases.

Paediatric TB cases represented 5% of cases overall, but reached 12% in Kyrgyzstan (new cases only) and Uzbekistan (Table 4). The age group 15-44 years accounted for 63% of cases notified (79% among foreigners in the Russian Fed, Table 5), while only 7% of cases were aged over 64 years. The high case-load in young and middle-aged adults indicates intense transmission in recent years.

In 2006, 87% (country range: 70-94%) of TB cases had pulmonary localisation, of which 39% (31-60%) were sputum smear positive (Tables 8, 12). Rates of pulmonary smear-positive TB were high (mean: 38/100,000, range: 27-117). More countries have reported data on smear-confirmation over time. In 2006, the proportion of retreated cases ranged widely from 6% to 46% (mean: 20%), reflecting differences in the definition of a notifiable case, even between neighbouring countries (Table 13). Compared to 2001, as national treatment programmes expanded, the proportion of retreated cases has increased in all countries except Belarus (no data in 2001), Georgia (stable and high), Turkmenistan and Ukraine.

Culture confirmation has improved since 2003 but still remains infrequent (6 countries reporting in 2006, mean: 34%, range: 1-47%, Table 14, Map 6).

Tuberculosis and HIV infection

Seven countries reported HIV sero-status of notified TB cases (Table 17), and HIV prevalence was 1% or lower in Armenia, Azerbaijan (2003), Belarus (2005), Georgia, Kazakhstan, Tajikistan (Dushanbe) and Uzbekistan. It was higher among new cases in the Russian Federation (1.7%) and Ukraine (5.1%). Azerbaijan and Uzbekistan did not report case-based AIDS data to EuroHIV for 2006, while the other 10 countries together reported 3,485 AIDS cases with initial TB diagnosis, of which 2,836 (81%) from Ukraine alone (Table 18). TB as initial AIDS indicative disease represented 6.9% of total TB cases notified in this country but less than 2.0% in the others. In 5 countries, including the Russian Federation and Ukraine, the number of AIDS-TB cases has clearly increased since 2000 (Table 19).

Low numbers of AIDS cases reported with TB may be due to AIDS underreporting in the East. On the other hand, high TB morbidity among AIDS cases may be influenced by the ease of diagnosis of TB over other AIDS-indicative diseases. However, it may also reflect associated risks for both HIV infection and TB disease in sub-populations like injecting drug-users. Surveillance data currently available in the East are insufficient to monitor the overlap between the HIV and TB epidemics, which are expected to increase both the TB and the MDR-TB case load in the coming years **[6]**.

Anti-tuberculosis drug resistance

In the East, all countries except Belarus and Tajikistan provided DRS data for 2006, albeit only Georgia's were nationwide and representative (Table 20, **[7]**). Results from Kazakhstan in 2006 and previous years were comparable to the findings of a nationwide DST survey in 2001 (Country Profiles). Five countries had participated in international EQA activities since 2005 (Table 21). Levels of primary MDR were 7% in Georgia, 9-16% in Armenia, Kazakhstan, Russian Federation (3 regions), Ukraine (Donetsk region) and Uzbekistan, and 19-26% in Azerbaijan, Kyrgyzstan and Moldova. Prevalence in retreated cases was much higher (16-61%, Table 20). Despite the variable quality of data, this reinforces evidence from elsewhere indicating high prevalence of drug resistance in most countries of the former Soviet Union **[8-10]**.

Treatment outcome

All countries except Ukraine reported TOM data on 2005 cohorts of sputum smear positive pulmonary cases (smear or culture positive cases in Belarus, Table 28). Eight countries had complete nationwide cohorts, while Azerbaijan had a large proportion of cases lost to follow up and reports for the Russian Federation and Uzbekistan were restricted to DOTS units. In countries with complete data, the overall success ratio among previously untreated cases was 74% (range: 62-85%, Table 29). This low success was explained by a combination of high levels of failures (mean: 9%, range: 4-12%) and loss to follow up (9%, range: 6-20%). The proportion of cases lost to follow up precludes certain countries from attaining the 85% treatment success target (Country Profiles). Tajikistan (82% success in new cases) improved data completeness between 2004 and 2005. High failures indicate low effectiveness of initial regimens due to primary MDR and also poor treatment adherence. The proportion of failures among new cases was close to the proportion of primary MDR reported in countrywide surveys in Georgia (5% and 7% respectively, Tables 24, 29) and Kazakhstan (12% and 13%), although case-based data were not available to confirm any links.

Among retreated cases (Table 30), success was lower than 70% in all countries except Kyrgyzstan, while deaths, failures and loss to follow up (12%, 14%, 17% respectively in countries with complete data) were higher than among previously untreated cases.

2.4 TB mortality

Thirty-nine countries reported TB mortality data with complete nationwide coverage for at least one year between 2001 and 2006 (data from Serbia including Montenegro, Table 33). There was a wide regional gradient in the distribution of TB mortality rates (median rate for latest available year: 0.8/100,000, Table 34, Map 3), being 22.0/100,000 population in the East (range: 10.4-25.4), 3.3 in the Balkans (2.5-3.8) and 0.7 in the EU & West (0.0-9.6). Throughout much of the EU & West, TB mortality rates have decreased or remained stable of late. A net decrease in TB mortality rates over 4 to 5 consecutive years in excess of 10% a year was observed in the Czech Republic, Estonia, Finland, Hungary, Ireland, and Switzerland, while rates increased by more than 10% yearly in Belarus.

Across the Region, most TB deaths were from respiratory or miliary disease. Reporting practices may explain certain differences between countries, as for instance, a much larger proportion of TB deaths attributed to miliary disease in Lithuania than in neighbouring Estonia and Latvia. Codes for sequelae of TB and pneumoconiosis associated with TB - shown in Table 33 of this Report but otherwise excluded from TB mortality - were practically never recorded in the East. On the other hand, they were used to varying degrees by nearly all countries in the EU & West and Balkans. Their inclusion would increase TB deaths by about 18% in these two sub-regions. In places like Iceland, Norway and Sweden, codes for late effects were more often used than the standard disease codes for underlying cause of TB death.

TB deaths would be expected to occur among both the incident TB cases and the prevalent pool of patients. Under stable conditions, the relationship between reported TB cases in a country and TB deaths for a given year would be expected to reflect the lethality of the disease. However, under- or over-reporting of TB notifications (reported by national surveillance agencies) or TB deaths (from vital registration systems) would influence any association between these two indicators. In the European Region, the ratio of TB deaths to TB notifications showed no particular geographical pattern. Nonetheless, low death-to-notification ratios (<0.10) were restricted to Western countries, while all Former Soviet Union countries with comprehensive data had high ratios (0.1 or more). This may be due to MDR, which is commonly high in these countries (Table 20), but may also be the effect of high HIV co-morbidity, as in Ukraine (ratio 0.27, Tables 17, 18). The mean age of autochthonous TB cases is higher than that of foreign cases (Tables 4, 5), and death among cases in the EU & West is higher in nationals and known to increase with advancing age (Table 31, **[2]**). Low death-to-notification ratios in countries like Denmark, Israel, The Netherlands, Switzerland and the United Kingdom (0.03-0.05, up to 0.09 if including TB deaths from late effects) may be the result of a lower risk of dying among cases of foreign origin - currently representing more than half the TB notifications in these countries – compared to nationals. In contrast, Finland for instance, where most cases are autochthonous and mean age of the TB patient population is high, the ratio is also high (0.11, and 0.21 if including TB deaths from late effects). These observations suggest differences in risk of dying in the notified case, even if data collection practices may differ.

2.5 Conclusions and recommendations

Surveillance data for tuberculosis portray a diverse epidemiological situation in Europe. Countries of the former Soviet Union remain of concern, with high TB case burden even if the number of new cases has stabilised or is on the decrease. More information has become available attesting to the widespread presence of drug resistance, as well as a high frequency of HIV among new TB cases in Ukraine.

Most countries of the EU & West have continued to experience a steady decrease in overall TB incidence for a number of decades, even if briefly reversed in certain countries in the early 1990s [11]. This decline has been more marked in the autochthonous populations than in immigrants. However, cases in persons of foreign-origin appear to have stabilised in 2005-2006, albeit not in all countries.

Three broad TB epidemiological patterns can be discerned in the EU & West. In western, industrialised countries TB rates are low and disease increasingly aggregates in immigrants and in sub-groups and settings associated with poverty and lowered immunity. Drug-resistance is low but usually higher in cases of foreign origin. HIV-TB varies from low to high. In the Baltic States, TB rates are high, migrant TB is low, drug resistance is high and levels of HIV are increasing among TB patients. In central European states joining the EU since 2004 - several of which border FSU countries - TB incidence is moderate to high but on the decline, and cases of foreign origin, HIV co-morbidity and drug resistance are as yet uncommon.

While TB mortality rates are low in the EU & West, TB still contributes heavily to mortality from infectious diseases in the European Union and a study showed that total TB deaths exceeded those attributed to HIV-infection [12].

Most low incidence countries with data did not exceed the threshold frequencies for TB meningitis in under-5 year olds and for pulmonary sputum smear positive case rates above which continuation of universal BCG vaccination is recommended [13].

The TB case definition for surveillance was revised in 2006 by the European Centre for Disease Prevention and Control (ECDC) to enhance its utility in surveillance. Additional data collected in 2007 to permit classification of cases by the new definition, while very incomplete, did shed light on aspects like post-mortem detection and the use of laboratory testing other than culture and smear in surveillance.

Despite the progress, more effort is needed to improve the uptake of European surveillance recommendations and to ensure comparability of data between countries and over time, particularly in the East. This can be achieved by:

- increasing laboratory reporting of confirmatory TB test results to the surveillance authorities in parallel with case notification so as to improve completeness;
- increasing coverage of TB case-based reporting and adherence by countries to the case definition;
- implementing drug resistance surveillance more widely, either by collecting initial DST results for all cases or via periodic prevalence surveys [14];
- implementing treatment outcome monitoring and developing additional targets for treatment results, including outcome after 12-months;
- as in most countries TB patients represent a useful sentinel for the progression of the HIV epidemic, surveillance of HIV among TB cases using national TB and HIV/AIDS case reporting, or by conducting HIV prevalence surveys in areas with high or increasing HIV prevalence, is important [15];
- developing indicators to monitor TB control in risk groups, including TB screening, contact investigation and outbreak management, all crucial in low incidence countries [16].

Improved tuberculosis surveillance would be expected to contribute to public health action by:

- describing the TB situation in a more complete, accurate and timely way as a means to inform better the decision-makers on priorities in TB control across the different parts of the European Region;
- targeting high incidence zones (e.g. metropolitan areas [17]) and sub-populations (e.g. recent immigrants, prisoners) at increased risk of TB infection, drug-resistance or unfavourable outcome of disease in order to prioritise preventive measures. These groups may also be subject to under-reporting (Table 1);
- advocating for the joint case management of HIV/TB patients;
- putting laboratories on the fore front of public-health action, giving due importance to their role in confirmatory testing, detection of cases with directly transmissible disease, and drug-susceptibility testing;
- preventing the emergence of drug resistance by ensuring better case holding and management;
- sensitizing public health workers and clinicians to risk factors – particularly those modifiable - associated with unfavourable treatment outcome, to permit timely action on the individual patient level.

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