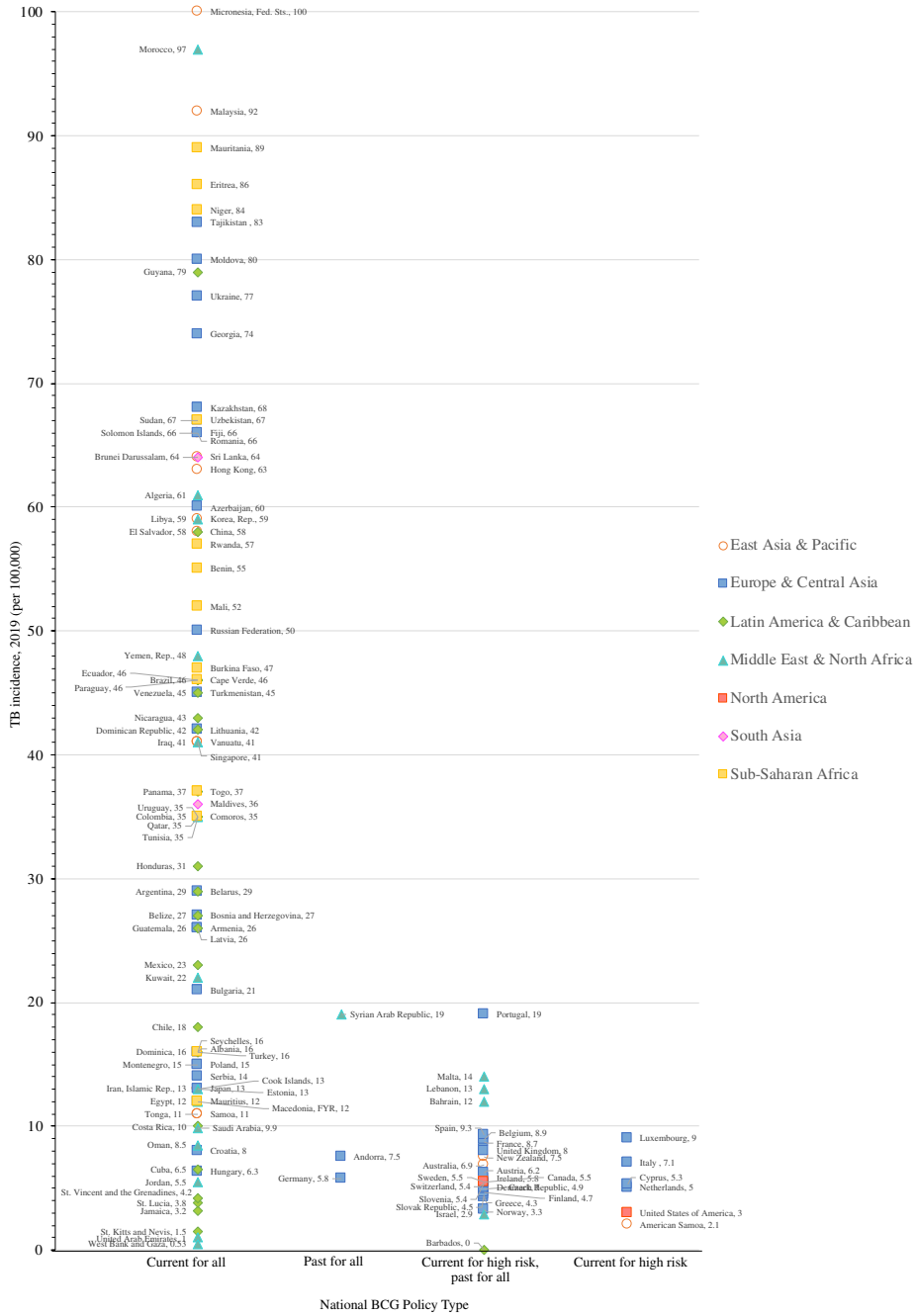
Supplemental material

Supplemental 1: All national BCG policy types for countries in the BCG Atlas with a TB incidence rate of less than 100 per 100,000 in 2019, by WB region



WB: World bank. TB cumulative incidence data (per 100,000) in 2019. Current national BCG policy types obtained from the BCG Atlas.

Supplemental Table 1: Definition of high-risk groups for countries who changed their national policy between 2009-2019, by policy type

Country (Year of change)	Definition of high-risk group*
From national vaccination for all to only high-risk groups	

Norway (2009)[1,2]	• In the childhood vaccination program for children and adolescents with one or both parents from countries with a high incidence of tuberculosis [determined by WHO]
	  ○ Infants (6 weeks of age)
	  ○ Older children and adolescents, if it is discovered that they have not been vaccinated before
	  ○ Adoptive children are usually not offered BCG vaccine after arrival in Norway
	• Persons who are to stay in countries with a high incidence of tuberculosis for more than 3 months and have close contact with the local population
	  ○ Children under 6 weeks - 18 years. The vaccine can be given for less than 6 weeks if contraindications (immune deficiency) are excluded
	  ○ People who are 35 years or younger can be considered for vaccination
	  ○ People who are to stay in areas with a high incidence of MDR-TB and have close contact with population groups with a high incidence of tuberculosis can, after a doctor's assessment, be offered BCG vaccine with a less severe indication.
	• Persons at risk of infection in a professional context, in accordance with regulations on the performance of work (*defined in 2018*).
	  ○ The Norwegian Institute of Public Health's recommendation on BCG vaccine in an occupational context will usually only include health personnel in the specialist health service who over time (approx. 3 months) will work with:
	  ○ Adult patients with infectious pulmonary tuberculosis
	  ○ Culture of mycobacteria in microbiological laboratory
	  ○ After individual assessment, BCG vaccine may also be relevant for some other employees in the health service, in prison or in the reception center, or when traveling abroad, see the section on BCG vaccination in a professional context below.
	• Other risk groups
	  ○ Children and younger adults on special indications if they are at increased risk of contracting tuberculosis. Vaccination in such cases should only be done on the doctor's recommendation

Czech Republic (2010)[3]	• The main indications for tuberculosis vaccination include a situation where one or both of the child's parents or a child's sibling or a member of the household in which the child lives had / has active tuberculosis, or when the child, or one or both of the child's parents or the child's sibling, or a member of the household in which the child lives, was born or has resided in a State with a higher incidence of tuberculosis than 40 cases per 100 000 population (*defined by WHO*), or was in contact with a patient with tuberculosis.

Spain (2010)[4]	• Vaccination in children and young people with close and prolonged contact (> 3 months) with tuberculosis (smear-positive adults, multidrug-resistant tuberculosis or with extended resistance) • Foreign-born children (<5 years) returning to their country (high burden) for >3 months • Health workers in frequent contact with tuberculosis patients and their biological tests, should be assessed individually • When other control strategies cannot be implemented or have failed
Slovakia (2012)[5,6]	• Newborns born in high-risk areas (Vyborna, Krizova Ves, Hranovnica) • Contacts of active tuberculosis cases vaccinated • Tuberculin negative people in high-risk professions (health workers and students, microbiologists and veterinarian at high risk of infection)
Belgium (2013)+ [7,8]	• Children younger than 5 years of ethnic minorities from countries with a high prevalence of tuberculosis, • Only for children under the age of 5 who regularly or for a longer period travel to or stay in a country with a high incidence of tuberculosis or have parents from high prevalence • Health workers who will be in contact with great certainty with multidrug-resistant patients or samples, vaccination is still considered / recommended…The risk in the workplace must be assessed on an individual basis by a recognized occupational physician, who will then make the assessment
Malta (2013)[9]	• Children born in high tuberculosis incidence countries or born in Malta where the provenance of at least one parent (or grand-parent) is from a region with a high incidence of tuberculosis • Previously unvaccinated tuberculin-negative travellers under 16 years of age, going to live or work with local populations for three or more months in a country where the annual incidence is > 40/100,000 population • Individuals at occupational risk including healthcare workers aged ≤ 35 years of age, irrespective of the duration of stay
Barbados (2016)[10]	• Administered to children under one year of age who live or frequent areas with a high burden of tuberculosis disease
Greece (2016)[11]	• At birth in high-risk neonates • The vaccine is also recommended for infants and children up to the age of 5 years belong to the high-risk groups and have not been vaccinated with BCG. • Newborns and children of immigrants living in difficult conditions. • Roma infants and children as well as other population groups that live in difficult conditions. • Newborns and infants of HIV-positive (+) mothers (excluding those who already have symptoms of infant AIDS). • Children in the immediate environment of whom there is a person with tuberculosis which does not comply with the treatment or suffers from multidrug disease and the child cannot be removed.
Portugal (2016)[12,13]	• Infants born in countries where the rates of tuberculosis are high (as per Standard 6/2016) • Infants who have a parent born in a country where there is a high rate of tuberculosis • Long term travellers for high-risk countries
Changed their definition of high-risk group	

France (2010)[14]	• Child born in a highly endemic tuberculosis country or with at least one parent from high endemic countries • Child who must stay at least one continuous month in high incidence countries • Child with a family history of tuberculosis (collateral or direct ascendants) • Child residing in Île-de-France, Guyana or Mayotte • Child in any situation deemed by the doctor to be at risk of exposure to tuberculosis
Slovenia (2015)[15]	• Newborn infants of immigrant families who moved to Slovenia from countries with a high incidence of tuberculosis in the last 5 years • Children whose mothers are being treated for tuberculosis • Children who will frequently visit countries with a high incidence of tuberculosis in the first years of life.
Sweden (2017)[16]	Children who, according to the following criteria, are at increased risk of being exposed to tuberculosis infection: • Family origin from a country with an increased or high incidence of tuberculosis (defined as > 40 cases and high incidence as > 100 cases /100,000 inhabitants per year) Other children and young people up to the age of 18: • Current active TB with a close relative or household contact (consultation is done with treating physician with regard to any ongoing infection tracing or treatment for TB and the time of BCG) For other children and adolescents, BCG vaccination may be considered ahead of schedule • Longer stay (more than three months) in a country or area with a high TB incidence, if the person comes into close contact with the local population.
Ceased vaccination	
Ireland (2015)† [17]	• Children in at-risk environments include those who are contacts of a pulmonary TB case, who are from an area of high endemicity (annual TB rates of ≥ 40/100,000) or whose parents are from an area of high endemicity or who have household contacts who belong to an at-risk group for TB • Unvaccinated (that is without adequate documentation or a characteristic scar) Mantoux negative immigrants under 16 years of age who were born or who have lived for a prolonged period (at least three months) in a high incidence country or aged 16-35 years from a sub-Saharan African country or country with a TB incidence of 500 per 100,000 • Unvaccinated Mantoux negative contacts aged 35 years and under of cases with active pulmonary TB. Children under five years of age in contact with smear positive TB should be referred to a contact tracing clinic for investigation and then immunised with BCG as indicated. • Members of special at-risk groups such as the travelling community due to the logistical difficulties of providing alternative control measures and follow up of contacts • Unvaccinated Mantoux negative persons under 16 years of age intending to live or work with local people in high incidence countries for more than one month • BCG is indicated for unvaccinated healthcare workers (HCWs) aged <35 years who are tuberculin skin test (TST) negative and who will have contact with patients or with clinically contaminated materials. Not all HCWs are at equal risk of TB. A risk assessment should be carried out to see if BCG is indicated

	for unvaccinated HCWs aged 35 years and older who are TST negative, taking into account their country of origin and the nature of their work. • Those more likely than the general population to come into contact with someone with infectious sputum smear positive TB (veterinary, prison, elderly and homeless facility staff)

*Definitions taken directly from policy documents and translated, when necessary, with Google Translate

+Belgium changed from mass vaccination to high-risk groups and changed their definition in the same year

†Although BCG vaccination stopped in 2015, high-risk groups are still listed

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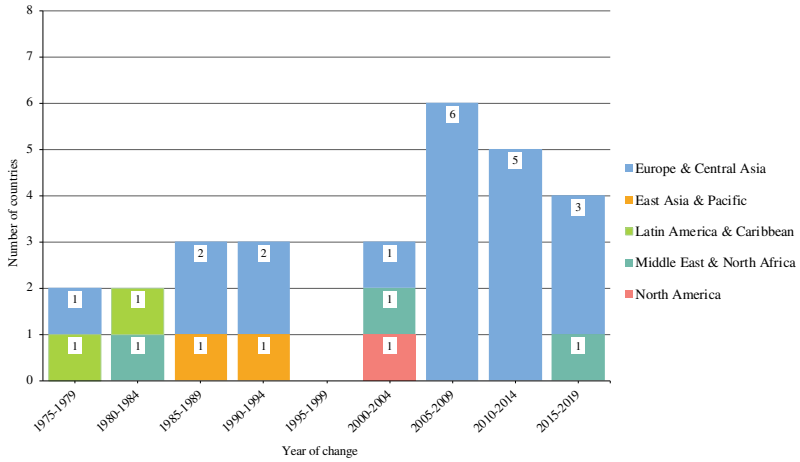
Supplemental Figure 2: Countries who changed their national BCG vaccine guidelines from mass neonatal vaccination to targeted approach between 1975-2019, by WB region (n=28)



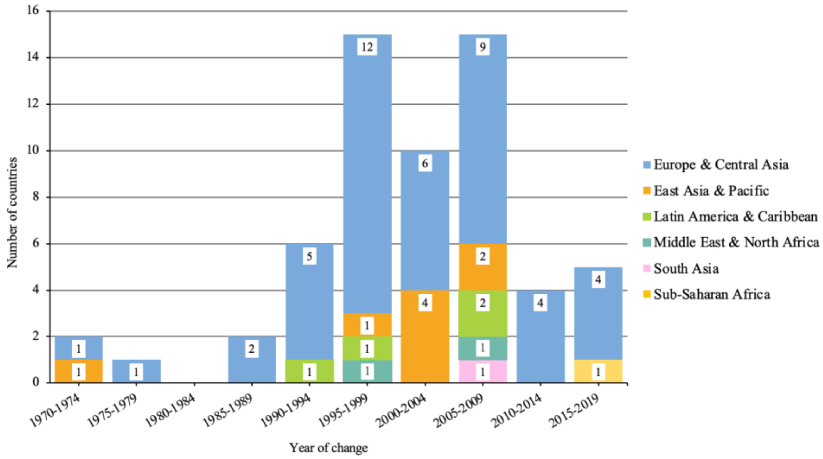
Supp. Figure 2 - WB: World bank. Two countries not shown with unknown year of change from mass vaccination to targeted approach for high-risk groups (Europe & Central Asia Region, Middle East & North Africa)

Supplemental Table 2: Countries who still recommend boosters doses or have changed their booster dose recommendations between 2009-2019

Country	WB Region	Booster vaccine timing	Booster vaccine policy change
Still recommend at least 1 booster dose			
Armenia	EU/CA	7 years	–
Bulgaria	EU/CA	7 and 12 years	–
Kazakhstan	EU/CA	6 years	–
Russian Federation	EU/CA	7 years	–
Sri Lanka	SA	6 months to 5 years	–
Tajikistan	EU/CA	6 years	–
Turkmenistan	EU/CA	14 years	–
Removal of booster doses between 2009-2019			
Belarus	EU/CA	6 and 12 years	2016
Bhutan	SA	Unknown	2009
Bulgaria*	EU/CA	17 years	2016
Croatia	EU/CA	13 years	2014
Czech Republic	EU/CA	10 years	2009
Moldova	EU/CA	6 years	2014
Russian Federation*	EU/CA	14 years	2014
Seychelles	SSA	6 years	2016
Slovakia	EU/CA	11-13 years	2010
Ukraine	EU/CA	7 years	2018
Uzbekistan	EU/CA	7 and 14 years	2015

WB = World Bank. *Other booster doses remain. EU/CA= Europe & Central Asia, SA = South Asia, SSA = Sub-Saharan Africa

Supplemental Figure 3: Countries who removed BCG vaccine booster doses from their national vaccination guidelines between 1970-2019, by WB region (n=60)



Supp. Figure 3 - WB: World bank. 9 countries not shown with unknown year of change for the removal of booster doses from the immunization schedule (all from Europe & Central Asia Region)