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Stop measles in Switzerland - The importance of travel medicine

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Abstract: **BACKGROUND:** In line with the worldwide strive to combat measles, the Swiss Federal Office of Public Health (FOPH) launched a National Strategy for measles elimination 2011-2015. In this study, we highlight the importance of travel medicine consultations to complement measles vaccination programmes based on data from the Travel Clinic of the University of Zurich. **METHOD:** We analysed measles vaccination data from the Zurich Travel Clinic between July 2010 and February 2016 and focused on three groups: (i) all clients who received the measles vaccination, (ii) all clients aged >two years who received the measles vaccination ("catch-up vaccination"), and (iii) all clients aged >two years and born after 1963 ("FOPH recommended catch-up vaccination"). **RESULTS:** 107,669 consultations were performed from 2010 to 2016. In 12,470 (11.6%) of these, a measles vaccination was administered; 90.9% measles vaccinations were given during a pre-travel consultation, and 99.4% were administered to individuals aged >two years ("catch-up vaccinations"). An "FOPH recommended catch-up vaccination" was received by 13.6% of all Zurich Travel Clinic clients aged >2years and born after 1963. **CONCLUSIONS:** In this study, we highlight the importance of travel medicine consultations to enhance the measles vaccination coverage in the adult Swiss population.

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1 **Stop Measles in Switzerland – The Importance of Travel Medicine**

2

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24

25 **Abstract**

26 **Background** In line with the worldwide strive to combat measles, the Swiss Federal Office of Public
27 Health (FOPH) launched a National Strategy for measles elimination 2011-2015. In this study, we
28 highlight the importance of travel medicine consultations to complement measles vaccination
29 programme based on data from the Travel Clinic of the University of Zurich.

30 **Method** We analysed measles vaccination data from the Zurich Travel Clinic between July 2010 and
31 February 2016 and focused on three groups: (i) all clients who received the measles vaccination, (ii)
32 all clients aged > two years who received the measles vaccination (“catch-up vaccination”), and (iii)
33 all clients aged > two years and born after 1963 (“FOPH recommended catch-up vaccination”).

34 **Results** 107,669 consultations were performed from 2010 to 2016. In 12,470 (11.6%) of these, a
35 measles vaccination was administered; 90.9% measles vaccinations were given during a pre-travel
36 consultation, and 99.4% were administered to individuals aged > two years (“catch-up vaccinations”).
37 An “FOPH recommended catch-up vaccination” was received by 13.6% of all Zurich Travel Clinic
38 clients aged > 2 years and born after 1963.

39 **Conclusions** In this study, we highlight the importance of travel medicine consultations to enhance
40 the measles vaccination coverage in the adult Swiss population.

41

42 **Key words**

43 measles, measles vaccine, elimination, travel medicine

44 **1. Introduction**

45 Measles is a highly infectious, airborne-transmitted disease with a basic reproduction number of 12 to
46 18 [1] and is one of the leading causes of death in young children globally. Clinical syndromes
47 include fever, conjunctivitis, coryza, cough, mucosal white spots and a red generalised rash [2].
48 Case-fatality rates are estimated to be three to five percent in low-income countries while severe
49 complications occur in five to ten percent of measles infections in high-income countries. In rare
50 cases, an acute encephalitis can occur and even years after infection a subacute sclerosing
51 panencephalitis can develop [3].

52 Globally, significant progress has been made to decrease the contribution of measles to the burden
53 of childhood deaths by making a safe and cost-effective vaccine available. As a consequence,
54 measles cases have dramatically declined [2].

55 In line with the Measles and Rubella Initiative [4], supported by the World Health Organization
56 (WHO), the Swiss Federal Office of Public Health (FOPH) launched a National Strategy for measles
57 elimination 2011 to 2015 [5]. In Switzerland, the recommendation for a primary measles vaccination
58 dose was introduced in 1976, and for the secondary dose in 1996. The first measles vaccination is
59 recommended at the age of 12 months followed by the second one between 15 and 24 months [6],
60 however vaccination is not compulsory in Switzerland. A large percentage of adults has only received
61 one dose during childhood and catch-up vaccinations (defined as: vaccinations after the age of two
62 years) are an important task on the road to measles elimination [7]. The FOPH recommends catch-
63 up vaccinations in all individuals born after 1963 as it is assumed that those born in 1963 or earlier
64 have already acquired lifelong immunity due to natural measles infection.

65 In Switzerland, the coverage with two measles vaccine doses was 89% in two-year-olds in 2012, but
66 only 77% in 20 to 29-year olds [8]. While coverage has improved in the younger children, it is
67 lingering behind in the adolescents and adults [9,10]. To stop the spread of measles, an immunity of
68 95% of the population is required (herd immunity) [1]. Measles cases dropped from 662 in 2011 to 63
69 in 2012. In 2013, 176 cases were recorded, 23 in 2014 and 35 in 2015 [11]. Measles incidence was
70 2.17/100,000 inhabitants in 2013, 0.3/100,000 in 2014, and 0.8 per 100,000 inhabitants in 2016

71 [12,13]. In Europe, between February 2015 and February 2016, 3,118 measles cases were reported
72 [14]. During a large outbreak in Berlin in 2014/2015 a one and a half-year-old boy died due to
73 complications [15].

74 Recently the Swiss FOPH published a report on administered catch-up vaccinations during the Swiss
75 measles elimination campaign for a representative sample of general practitioners (GPs), internal
76 medicine specialists, and paediatricians [7]. Based on extrapolation of these available data, in 2014,
77 33,500 catch-up vaccinations were administered by these specialists. Other vaccination settings,
78 such as schools, the Swiss army, gynaecologists and travel medicine clinics were not included. In
79 this study, we illustrate the importance of travel medicine consultations to complement measles
80 catch-up shots based on data from the Travel Clinic of the University of Zurich. The Zurich Travel
81 Clinic is the largest travel clinic in Switzerland (around 17,000 consultations per year); it covers the
82 majority of Zurich travellers seeking pre-travel advice before their trips to tropical/subtropical
83 countries.

84

85

86 **2. Methods**

87

88 **2.1 Data collection**

89 At the Zurich Travel Clinic, all clients complete an electronic form in a closed electronic system before
90 their consultations, including the reason for the consultation and demographic information (sex, age,
91 place of residence). Physicians of the travel clinic routinely verify the information provided by the
92 clients and add data on administered measles vaccinations to the client's record. For this analysis all
93 vaccines containing measles were taken into account, irrespective of being monovalent, trivalent or
94 quadrivalent vaccines. From the data, we could not differentiate between primary and secondary
95 vaccinations. For this retrospective anonymous data analysis, no ethics committee approval was
96 required.

97 **2.2 Data analysis**

98 Data were analysed anonymously with Stata 13.1 (StataCorp College Station, TX, USA). Cantons of
99 residence were coded based on places of residence. For continuous variables, the mean and
100 standard deviation (SD) were reported. We focused on three client groups: (i) all clients who received
101 the measles vaccination, (ii) all clients above the age of two years who received the measles
102 vaccination ("catch-up vaccination"), and (iii) all clients above the age of two years and born after
103 1963 ("FOPH recommended catch-up vaccination").

104 In order to project how many individuals should have received a measles vaccine, population data for
105 Switzerland was obtained for the years 2011 until 2014 from the Swiss Federal Statistical Office [24]
106 for the respective age groups we looked at in our sample. Based on these numbers, an extrapolation
107 was made to the general population.

108

109 **3. Results**

110 Between July 2010 and February 2016, 107,669 consultations were performed at the Zurich Travel
111 Clinic. Of these, 12,470 (11.6%) measles vaccinations were administered.

112 While 16.6% of all clients of the Travel Clinic received a measles vaccination in 2010, the percentage
113 dropped to around 8.5% in 2015/2016 (**Figure 1**).

114 Overall 47.9% of Travel Clinic clients were male (50,186). Of all vaccinated clients, 53.7% were male
115 (6,650) and 46.3% female clients (5,744). The mean age of the vaccinees at measles vaccination
116 was 33.9 years, SD 8.4 years; 50% were vaccinated between the age of 28.6 and 39.5 years. 12,356
117 vaccine doses (99.5%) were administered to individuals above the age of two years (“catch-up
118 vaccinations”, **Table 1**).

119

120 **Table 1:** Age groups of clients at the Zurich Travel Clinic who received a measles vaccination
121 between July 2010 and February 2016

Age group	n (%)
≤ 2 years	70 (0.6)
> 2 and < 18 years	173 (1.4)
≥ 18 years and born after 1963	11,877 (95.6)
Born before 1963	306 (2.5)

122

123

124

125 Of the clients aged >2 years and born after 1963, 13.6% received the measles vaccination at our
126 Clinic, compared to only 1.5% of those born in 1963 and earlier. The vast majority (n=11,010, 90.9%)
127 of measles vaccinations were administered during a travel consultation (**Figure 2**).

128 Most measles vaccinations were administered to clients who were residents of the Canton of Zurich
 129 (87.0%) followed by clients residing in the Canton of Aargau (4.1%); 1.5% of clients with a measles
 130 vaccination came from the Canton of Zug, 1.4% from Canton of St. Gallen and 1.3% from the Canton
 131 of Schwyz. The remaining 4.7% came from all other Swiss cantons and abroad.

132 Between 2010 and 2016, 13.6% of clients aged > 2 years and born after 1963 received an “FOPH
 133 recommended catch-up vaccination”. As overall measles vaccination numbers in Switzerland are not
 134 available, we projected the percentage of measles vaccinated clients to the Swiss general population
 135 between 2011 and 2014. Based on the Zurich Travel Clinic data, per year between 555,000 and
 136 850,000 inhabitants of Switzerland, born after 1963 and older than 2 years, should have received a
 137 measles vaccination (**Table 2**).

138

139 **Table 2:** Measles vaccination in the Zurich Travel Clinic in clients born after 1963 and aged > 2 years
 140 and projected numbers for the Swiss population

Year	Clients born after 1963 and aged > 2 years; n	Clients born after 1963 and aged > 2 years with measles vaccination; n (%)	Swiss population born after 1963 and aged > 2 years; n	Swiss population born after 1963 and aged > 2 years who should have received measles vaccination if vaccination coverage was as high as in the Zurich Travel Clinic; n
2011	12,162	2,217 (18.2)	4,682,434	852,203
2012	12,946	2,120 (16.4)	4,826,734	791,584
2013	12,685	1,643 (13.0)	4,986,108	648,194
2014	13,914	1,502 (10.8)	5,142,124	555,349

141

142

143

144 4. Discussion

145 In the Zurich Travel Clinic, between 2011 and 2016 11.6% of all clients received a measles
146 vaccination during their consultation. More than 90% of measles vaccinations were administered
147 during a travel consultation. The percentage of clients vaccinated against measles aged >2 years
148 who were born after 1963, was even higher with 13.6%. This percentage appears high when
149 compared with the sentinella sample of GPs, internal medicine specialists and paediatricians
150 described in the FOPH report on “recommended catch-up vaccinations” administered in 2014 [7]. In
151 this sample of 166 physicians, on average only 4.4 measles doses were given during a 10-month
152 interval. However, it has to be kept in mind that individuals consulting a Travel Clinic may differ from
153 the general population seeking advice at a GP, an internal medicine specialist or paediatrician.

154 The importance of travel medicine in updating generally recommended vaccinations such as measles
155 has also been highlighted in a few international studies [25,26]. Updating of generally recommended
156 vaccinations during travel consultations is an important chance to catch people who would normally
157 not consult their GP only for missing vaccination shots, especially in countries, such as Switzerland,
158 where vaccinations are not mandatory. The relatively high percentage of men that were vaccinated in
159 our Clinic underlines this observation, as this group is less likely to consult their general practitioners
160 for health issues [27], let alone to have their vaccination status updated. Moreover, individuals who
161 are normally more sceptical of vaccinations tend to be more willing to accept vaccine shots, even
162 multiple ones simultaneously, when needed and perceived to be adequate for travelling abroad,
163 especially to exotic destinations [28,29].

164 Updating measles vaccinations in travel clinics is not only important for the elimination in clients’
165 home countries, but also to prevent the spread of measles by travelling abroad to regions where
166 measles have previously been eliminated or there is a low endemicity [30]. Two sad and disturbing
167 examples are the recent export of measles from Switzerland to Columbia at the end of 2015 and to
168 Australia in early 2016 [31,32].

169 As part of the FOPH measles elimination campaign to increase coverage, measles vaccination was
170 offered at a reduced fee between 2013 and 2015. In our analysis, we could not demonstrate an

171 increase in measles vaccine uptake during this period across all age groups. On the contrary,
172 measles uptake declined from 2011 to 2016. We can only speculate why this was the case: improved
173 vaccination status among the clients or possibly less insistence on good vaccination coverage by the
174 attending health staff.

175 Despite the increase in vaccination coverage and the intense efforts invested in the campaign,
176 measles elimination was not achieved in Switzerland by 2015. Measles incidence for the first five
177 months in 2017 has already reached 2.56/100,000 inhabitants, with outbreaks in the cantons Ticino,
178 Grisons, Schwyz, Zurich and Vaud [33]. Furthermore, just recently a young adult suffering from
179 leukaemia died from measles complications, despite being vaccinated; due to his illness, his
180 weakened immune system did not elicit enough protection against the virus [34]. The last fatality due
181 to measles was in 2009. It is thus important, that as many individuals be vaccinated as possible to
182 protect those who cannot be vaccinated, or cannot acquire immunity through vaccination. Still striving
183 to achieve the goal of the elimination of measles, the FOPH has developed a new strategy for
184 vaccination by building on the results and knowledge obtained in the original campaign [35]. This
185 strategy calls for, among others, improving the roles of the health care providers and better access to
186 vaccination for adults, which emphasizes the critical position of a travel clinic in increasing measles
187 vaccination coverage among healthy adults.

188 One limitation of our study was that we could not differentiate between primary and secondary
189 measles vaccination. For this reason and also due to potentially other unknown variables the
190 extrapolation should be interpreted with caution.

191 Furthermore, the vaccination status of clients was not systematically recorded; hence, we could not
192 analyse the completion of measles vaccination status in clients who did not receive a measles
193 vaccination at the Zurich Travel Clinic.

194

195

196 **5. Conclusion**

197 In addition to general practitioners and other health professionals, pre-travel consultations provided
198 at travel clinics, play a key role in measles elimination in high-income countries and can contribute to
199 a higher coverage in their catchment areas while preventing the possibility of being a source of
200 measles outbreaks abroad. Especially young adults and the healthy travelling population can be
201 targeted who may not visit health care professionals routinely.

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209 **Contributorship Statement:**

210 All authors have made substantial contributions to either of the following: the design of the study,
211 analysis and interpretation of data, drafting the article or revising it critically for important intellectual
212 content. All authors have approved the final version of the manuscript.

213 **Conflict of interest:**

214 None.

215 **References**

- 216 [1] Heymann DL. Control of Communicable Diseases. Washington, D.C., USA: American Public
217 Health Association; 2008.
- 218 [2] World Health Organization. Measles Factsheet 2016.
- 219 [3] The Centers for Disease Control and Prevention. Complications of Measles. Measles
220 (Rubeola) 2013.
- 221 [4] Measles and Rubella Initiative. A global initiative to stop measles and rubella n.d.
- 222 [5] Schweizerisches Bundesamt für Gesundheit. Stop Masern n.d.
- 223 [6] Schweizerisches Bundesamt für Gesundheit. Schweizerischer Impfplan 2016 2016.
- 224 [7] Schweizerisches Bundesamt für Gesundheit. Nachholimpfung gegen Masern 2014:
225 ermutigende Ergebnisse. 2015.
- 226 [8] Schweizerisches Bundesamt für Gesundheit. Masern-Durchimpfung in der Schweiz:
227 kantonale und nationale Werte 1999–2014. 2015.
- 228 [9] BAG - Bundesamt für Gesundheit. Durchimpfung von 2-, 8- und 16-Jährigen in der Schweiz,
229 2011 bis 2013 2015.
- 230 [10] Valeri F, Hatz C, Jordan D, Leuthold C, Czock A, Lang P. Immunisation coverage of adults: a
231 vaccination counselling campaign in the pharmacies in Switzerland. *Swiss Med Wkly*
232 2014;144:w13955.
- 233 [11] Schweizerisches Bundesamt für Gesundheit. Schweiz ohne Masern: Der Weg geht weiter.
234 2016.
- 235 [12] World Health Organization. Reported measles cases and incidence rates by WHO Member
236 States 2013, 2014 as of 11 February 2015 2015.
- 237 [13] Schweizerisches Bundesamt für Gesundheit. BAG Bulletin 50/2016 2016.
- 238 [14] European Centre for Disease Prevention and Control. Surveillance Atlas of Infectious Disease
239 2016.
- 240 [15] Robert Koch Institut. Berliner Masernausbruch 2014/2015 2015.
- 241 [16] European Centre for Disease Prevention and Control (ECDC) - Health Communication Unit -
242 Eurosurveillance editorial. Mandatory and recommended vaccination in the EU, Iceland and
243 Norway: results of the VENICE 2010 survey on the ways of implementing national vaccination

- 244 programmes 2012.
- 245 [17] WHO, Unicef. Slovakia: WHO and UNICEF estimates of immunization coverage: 2015
246 revision 2015.
- 247 [18] WHO, Unicef. Hungary: WHO and UNICEF estimates of immunization coverage: 2015
248 revision 2015.
- 249 [19] National Health System. NHS Immunisation Statistics England 2013-14 2014.
- 250 [20] WHO, Unicef. United Kingdom: WHO and UNICEF estimates of immunization coverage: 2015
251 revision 2015.
- 252 [21] The Centers for Disease Control and Prevention. State Vaccination Requirements 2016.
- 253 [22] The Centers for Disease Control and Prevention. New Vaccination Criteria for U.S.
254 Immigration 2012.
- 255 [23] The Centers for Disease Control and Prevention. Immunization 2015.
- 256 [24] Schweizerisches Bundesamt für Statistik. Ständige Wohnbevölkerung nach Alter, Geschlecht
257 und Staatsangehörigkeitskategorie 2015.
- 258 [25] Sotir MJ, Esposito DH, Barnett ED, Leder K, Kozarsky PE, Lim PL, et al. Measles in the 21st
259 Century, a Continuing Preventable Risk to Travelers: Data From the GeoSentinel Global
260 Network. *Clin Infect Dis* 2016;62:210–2.
- 261 [26] Rapose A. Measles and pertussis outbreaks: an important role for travel clinics. *Am J Infect
262 Control* 2013;41:1140.
- 263 [27] Thompson AE, Anisimowicz Y, Miedema B, Hogg W, Wodchis WP, Aubrey-Bassler K. The
264 influence of gender and other patient characteristics on health care-seeking behaviour: a
265 QUALICOPC study. *BMC Fam Pract* 2016;17:38.
- 266 [28] Salis Gross L, Tatzel J, Lang P, Rauber G, C H. Explorative Studie zur Akzeptanz des Impfens
267 in impfkritischen Bevölkerungsgruppen der Schweiz. Bern: 2014.
- 268 [29] Velan B, Boyko V, Lerner-Geva L, Ziv A, Yagar Y, Kaplan G. Individualism, acceptance and
269 differentiation as attitude traits in the public's response to vaccination. *Hum Vaccin
270 Immunother* 2012;8:1272–82.
- 271 [30] Jost M, Luzi D, Metzler S, Miran B, Mutsch M. Measles associated with international travel in
272 the region of the Americas, Australia and Europe, 2001-2013: a systematic review. *Travel Med*

- 273 Infect Dis 2015;13:10–8.
- 274 [31] 20 Minuten. Schweizerin löst Masern-Alarm in Australien aus 2016.
- 275 [32] Schweizerisches Bundesamt für Gesundheit. Masern - Lagebericht (April 2016) 2016.
- 276 **[33]** Schweizerisches Bundesamt für Gesundheit. Zahlen zu Infektionskrankheiten (Mai 2017)
- 277 2015.[https://www.bag.admin.ch/bag/de/home/service/zahlen-fakten/zahlen-zu-](https://www.bag.admin.ch/bag/de/home/service/zahlen-fakten/zahlen-zu-infektionskrankheiten.exturl.html/aHR0cDovL3d3dy5iYWctYW53LmFkbWluLmNoLzlwMTZfbWVsZG/VzeXN0ZW1lL2luZnJlcG9ydGluZy9kYXRlbnRldGFpbHMvZC9t/YXNlcm4uaHRtbD93ZWJncmFiPWlnbm9yZQ==.html)
- 278 [infektionskrankheiten.exturl.html/aHR0cDovL3d3dy5iYWctYW53LmFkbWluLmNoLzlwMTZfb](https://www.bag.admin.ch/bag/de/home/service/zahlen-fakten/zahlen-zu-infektionskrankheiten.exturl.html/aHR0cDovL3d3dy5iYWctYW53LmFkbWluLmNoLzlwMTZfbWVsZG/VzeXN0ZW1lL2luZnJlcG9ydGluZy9kYXRlbnRldGFpbHMvZC9t/YXNlcm4uaHRtbD93ZWJncmFiPWlnbm9yZQ==.html)
- 279 [WVsZG/VzeXN0ZW1lL2luZnJlcG9ydGluZy9kYXRlbnRldGFpbHMvZC9t/YXNlcm4uaHRtbD93](https://www.bag.admin.ch/bag/de/home/service/zahlen-fakten/zahlen-zu-infektionskrankheiten.exturl.html/aHR0cDovL3d3dy5iYWctYW53LmFkbWluLmNoLzlwMTZfbWVsZG/VzeXN0ZW1lL2luZnJlcG9ydGluZy9kYXRlbnRldGFpbHMvZC9t/YXNlcm4uaHRtbD93ZWJncmFiPWlnbm9yZQ==.html)
- 280 [ZWJncmFiPWlnbm9yZQ==.html](https://www.bag.admin.ch/bag/de/home/service/zahlen-fakten/zahlen-zu-infektionskrankheiten.exturl.html/aHR0cDovL3d3dy5iYWctYW53LmFkbWluLmNoLzlwMTZfbWVsZG/VzeXN0ZW1lL2luZnJlcG9ydGluZy9kYXRlbnRldGFpbHMvZC9t/YXNlcm4uaHRtbD93ZWJncmFiPWlnbm9yZQ==.html) (accessed May 10, 2017).
- 281 [34] Tagesanzeiger. Erster Masern-Toter in der Schweiz seit Jahren.
- 282 [http://www.tagesanzeiger.ch/wissen/medizin-und-psychologie/die-masern-breiten-sich-](http://www.tagesanzeiger.ch/wissen/medizin-und-psychologie/die-masern-breiten-sich-aus/story/18826873)
- 283 [aus/story/18826873](http://www.tagesanzeiger.ch/wissen/medizin-und-psychologie/die-masern-breiten-sich-aus/story/18826873) (accessed March 24, 2017).
- 284 [35] Schweizerisches Bundesamt für Gesundheit. Nationale Strategie zu Impfungen (NSI)
- 285 [https://www.bag.admin.ch/bag/de/home/themen/strategien-politik/nationale-](https://www.bag.admin.ch/bag/de/home/themen/strategien-politik/nationale-gesundheitsstrategien/nationale-strategie-impfungen-nsi.html)
- 286 [gesundheitsstrategien/nationale-strategie-impfungen-nsi.html](https://www.bag.admin.ch/bag/de/home/themen/strategien-politik/nationale-gesundheitsstrategien/nationale-strategie-impfungen-nsi.html) (accessed May 10, 2017).

287 **Figure legend**

288

289 **Figure 1:** Percentage of Travel Clinic clients with measles vaccination according to year (2010-2016)

290 **Figure 2:** Measles vaccinations at the Zurich Travel Clinic according to reasons for consultation visits
291 between July 2010 and February 2016