Int J Public Health (2012) 57:659–671
DOI 10.1007/s00038-012-0375-8

REVIEW

The health of migrant children in Switzerland

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Received: 8 December 2011 / Revised: 19 May 2012 / Accepted: 21 May 2012 / Published online: 15 June 2012

Abstract
Objective Over 22 % of children and adolescents living in Switzerland have a migrant background. The aim of this systematic literature review is to give an overview of health needs of paediatric migrants in Switzerland.
Methods Three databases (Embase, Medline, Global health) were systematically searched for quantitative primary research on the health outcomes of migrant minors (<18-year old) in Switzerland, including articles published since 2000 in French, German, Italian or English. Citation chasing and search of non-indexed literature was also performed.
Results Thirty publications were identified. Compared to their Swiss peers, migrant children had higher hospitalisation (+40 %) and intensive care admission rates, more dental cavities, twice the odds of being obese, and migrant adolescents seemed more frequently affected by psychological problems and twice as often requesting abortions. Certain infectious diseases (tuberculosis, intestinal parasites, *H. pylori* infection, Hepatitis A) were more prevalent. Increased neonatal and infant mortality rates were found in Turkish and African babies.
Conclusion Children of migrants may have distinct health needs. They should benefit from migrant paediatric care and health promotion activities that recognise these.

Keywords Migrant · Immigrant · Foreign · Child · Paediatric · Switzerland

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Introduction

As global migration grows, populations in European countries are becoming increasingly diverse. Children make up a significant portion of the world's migrant population. Children migrate and are born into migrant families. Although migrant children may have health patterns and development issues similar to non-migrant children, migrant children are also likely to have specific health needs that require informed detection and targeted responses.

The aim of this systematic literature review is to provide an overview of the health of migrant children in Switzerland and identify some of their particular needs.

For this research, we use the definition of 'migrant children' proposed by the International Organisation of Migration (IOM) (Guerreiro et al. 2006), which includes: children who migrated alone or with their parents, children who are undocumented or have irregular status; second generation migrant children, refugee and asylum-seeking children; while defining a child as a person under 18, as established in the United Nations Convention on the Rights of the Child, 1989.

Switzerland and its immigrants

Twenty-two percent of Switzerland's 7.8 million residents are foreigners (Bundesamt für Statistik 2009). In 2008, approximately 30 % of inhabitants older than 15 years were of migrant background, i.e., have at least one parent with a foreign nationality at birth (Bundesamt für Statistik 2008). For children numbers are similar with 22.2 % of inhabitants under 20 years of age (Bundesamt für Statistik 2009) not having Swiss nationality. In some areas, such as the canton Basle-City, the proportion is even higher, with

up to 36 % of under 17-year-olds not being Swiss (Bevölkerungsdienste und Mitgration ESAdKB-S 2010). Many more children may have a migrant background but do not appear in statistics as they have obtained Swiss nationality.

The majority of foreign residents comes from neighbouring countries (mainly Germany 14.9 %, Italy 16.3 % and France 4.5 %), Portugal (12 %), Spain (3.6 %), the Balkans (Serbia 6.9 %) and Turkey (4 %) (Bundesamt für Statistik 2009). Across the country, the distribution of migrants is uneven, with foreigners making up more than 30 % of the population in some cities and less than 10 % in other regions (Bundesamt für Statistik 2009).

In 2010, 69,335 people were registered with asylum authorities in Switzerland, being either still in the asylum process, accepted as refugees or awaiting return in their home countries if their request for asylum had been declined (Bundesamt für Migration 2011). In 2005, the number of undocumented migrants was estimated at 90,000 with some estimates reaching 300,000 (Longchamp et al. 2005).

Health of immigrants in Switzerland

Considering the above figures, the number of paediatric patients with a migrant background must be substantial. Still a majority of literature on migrant health focus on adults (Smith Nielsen and Krasnik 2010). To assess the health needs of migrant populations in Switzerland, the Swiss government conducted two cross-sectional studies [2004 and 2010 (Guggisberg et al. 2011)]. Self-reported health complaints, health behaviour and service utilisation of the largest migrant groups were compared to Swiss nationals excluding migrants from Latin America, Asia or Africa (except Somali). In these studies, nationals from northern and western European states living in Switzerland reported similar health, but the remaining groups worse health than the Swiss (Rommel et al. 2006). Newly arrived migrants and men tended to have better health than those who migrated long ago and migrant women. Children were not included (Rommel et al. 2006, Guggisberg et al. 2011).

The health of migrant children remains under-researched even within the paediatric literature. A study in Swedish schoolchildren indicated an increase in self-reported health complains in girls with foreign-born parents (Carlerby et al. 2011) indicating health concerns to be investigated. While research on subgroups of migrant children in Switzerland has been carried out e.g., as a hospital-based cross-sectional study reviewing consultations of asylum-seeking children (Manzano and Suter 2002), larger population-based evidence related to the health of migrant children in Switzerland is not yet available.

The aim of this systematic review is to identify research that assessed somatic and psychological health outcomes among migrant children to give an overview and contribute to an improved understanding of migrant child health needs in Switzerland.

Methods

A systematic literature review, guided by the PRISMA-statement (Moher et al. 2009), was conducted on health outcomes of migrant children in Switzerland.

Inclusion/exclusion criteria

We included all studies that directly or indirectly assessed health outcomes among migrant children (aged 18 or younger) living in Switzerland published during or after 2000. We included primary research in the form of trials, cross-sectional studies, cohort studies that was peer-reviewed or in the grey literature. We excluded case reports, editorials, review articles and qualitative research.

Search strategy

Three databases, Medline, Embase and Global health, were systematically searched using a search strategy that combined the key terms—migration, age and Switzerland. Articles in English and the three national languages of Switzerland (French, German and Italian) were included. The first stage of the review included articles published within the last 25 years to ensure that articles of major importance would not be overlooked by establishing 1999 as the date limit. Primary screening was based on titles and abstracts (Fig. 1), excluding articles not focusing on the health of migrant minors in Switzerland. After removing duplicates and ensuring that no articles of major importance would be omitted, only articles published during or after the year 2000 were included in order to identify evidence relevant to current policy and services. We also searched relevant migrant and paediatric health resources including, the Swiss Paediatric association's journal, "Paediatrica" and its website; as well as the "Swiss Medical Forum", "Schweizer Ärztezeitung", "Revue medical Suisse" and "Praxis" using relevant search terms in the main publication languages, German and French. The Swiss Forum for Migration webpage was also screened. This additional search and citation chasing identified seven additional (mainly non-peer reviewed) reports (Bollini and Wanner 2006) or publications.

Data extraction

Data extraction was conducted using a standardized form. The information collected included study design, study

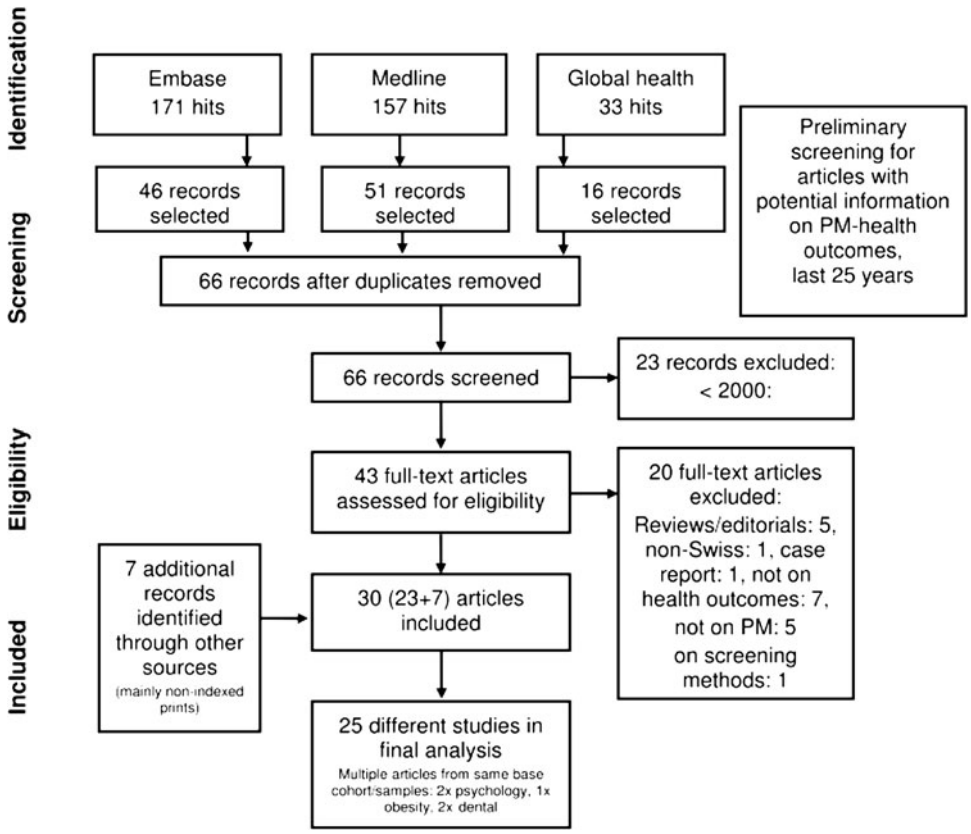

Fig. 1 Flowchart: systematic literature review paediatric migrant (PM) health Switzerland

size, population and comparison group, age group, health outcomes, geographical study area, and potential bias/confounding factors to assess their power, external validity and overall quality.

The selected articles were assessed for their quality in terms of validity, bias and confounding using the revised GATE quality appraisal checklist (National Institute for Health and Clinical Excellence 2009).

Statistical analysis

Due to the small sample size and heterogeneity of outcomes, we were unable to pool our results.

Results

The database search identified 43 articles published after 2000 for which the full text was reviewed. Of the 43, 23 met the inclusion criteria. Reference chasing and a gray literature search identified seven additional studies.

Ultimately, 30 publications met the inclusion criteria. Derived from 25 different studies, some had fed into several publications (Fig. 1). All but one (a cohort study (Hüsler and Plancherel 2007)) had a cross-sectional design. Study characteristics are listed in Table 1. The main health topics covered in these papers were: obesity (Bürgi et al. 2010; Ebenegger et al. 2011; Lasserre et al. 2007; Ledergerber and Steffen 2011; Stettler et al. 2004), psychological health (five papers, four based on two cohorts) (Steinhausen and Metzke 2000; Corigliano et al. 2007; Hüsler and Plancherel 2007; Hüsler and Werlen 2010; Steinhausen et al. 2009), infectious diseases (Collet et al. 2005; Heuberger et al. 2003; Mutsch et al. 2006), dental health (five articles based on three studies) (Menghini et al. 2003a, b, c, 2008a, b), adolescent abortions (Narring et al. 2002), neonatology (Bollini and In 2006; Merten et al. 2007; Villadsen et al. 2010), neural tube defects (Poretti et al. 2008), intensive care (Tritschler et al. 2011), hospitalisation rates (Schoeni-Affolter et al. 2008), maltreatment (Jud et al. 2010), accidents (Natterer et al. 2009; Mayer et al. 2006), and overall health of asylum-seeking children (Manzano and Suter 2002) and undocumented migrants (Depallens Villanueva et al. 2010). Details on outcomes are presented in Tables 2, 3, 4.

Most studies used Swiss peers as the comparative population in their analysis. In several studies, migration was not of primary interest but assessed as a potential confounder (Natterer et al. 2009; Schoeni-Affolter et al. 2008;

Table 1 Study characteristics

Authors	Sample size/data source	Migrant population	Age	Sex (male)
(a) Psychosocial				
Obesity				
Bürgi et al. (2010); Ebenegger et al. (2011)	542 of 727 recruited 72 % migrants "Ballabeina Study"	Places of birth foreign parent: mothers ($N = 315$): 19 % Portugal, 13 % Albania/Kosovo, 21 % other Europe, 10 % Africa, 9 % Asia, 8 % Latin America; rest 0.8 %; father ($N = 327$) 17 % Portugal, 13 % Albania/Kosovo, 20 % other Europe, 11 % Africa, 9 % Asia; ($N = 255$) had two migrant parents	Mean: 5.1 years (±0.6)	49 %
Lasserre et al. (2007)	5,207 (=76 % of 6,873) Age: 11–13 years	Not stated	Mean: 12.3 years (±0.5, range 10.1–14.9)	50 %
Ledergerber and Steffen (2011)	94,000—routine medical school check-up	Not stated	3 groups: 5.3 years (±0.5); 9.3 years (±0.5); 15.5 years(±0.6)	51 %
Stettler et al. (2004)	872 (of 922 recruited)	Not stated	Median: 8.0 years (6.5–10.0)	53 %
Dental				
Menghini (2008a, b)	771 of 1,000 randomly selected	Ex-Yugoslavia (12.5. %), other non-Swiss (27.1 %)	2-year-olds	51 %
Menghini et al. (2003b)	±1,400 children	Ex-Yugoslavia, Albania, others not stated	7–15 years	Not stated
Menghini et al. (2003a)	291 of 350 randomly selected	Idem other 2003 articles	5-year-olds	Not stated
Menghini et al. (2003c)	Combines other 2003 studies	Ex-Yugoslavia, Bulgaria, Romania, France, UK, Belgium, Norway, Germany, Estonia		Not stated
Psychological				
Corigliano et al. (2007)	26—retrospective review of pt files 2002–2005	Asylum seekers, NS	4.1–10 years	61 %
Hüsler and Werlen (2010)	1,352 in "supra-f" secondary prevention program	Second generation: 53 % Europe, 16 % Balkans, 31 % other, first generation 20 % Europe, 39 % Balkans, 41 % (Africa, Near East and USA)	11–20 years	71 %
Hüsler and Plancherel (2007)	614 in "supra-f" program	Not stated	11–20 years	70 %
Steinhausen and Metzke (2000)	567 ZESCAP-Study	Not stated	Mean: 14.8 years (±1.9) Range 12.3–17.9	52 %
Steinhausen et al. (2009)	1,239; ZESCAP-Study Self-reported behaviour/health	Not stated (Stratified, randomized sample: 12 nationalities different school types, 996 natives, 55 double citizens, 188 foreign)	Mean: 13.8 years (±1.6) Range 10–17 years	Overall 52 %, 57 % in migrants, 45 % in dual citizens

Table 1 continued

Authors	Sample size/data source	Migrant population	Age	Sex (male)
Abortions				
Narring et al. (2002)	357	Balkan/Portugal/Latin America/Central Africa	14–17 years	0 %
Accidents				
Mayer et al. (2006)	241 children with head injury and/or multiple trauma	Not stated	Falls: median: 2,6 years (0–13.6), other 6.7 years (0.4–16.4)	58 % in falls 64 % other
Natterer et al. (2009)	89 burn patients	(app. 50 % migrant)	0–16 years	56 %
Maltreatment				
Jud et al. (2010)	238	Mixed	Mean 7.5 (0–19) years	42 % (sex abuse 29 %, physical 57 %)
Infectious diseases and general health				
Infections				
Collet et al. (2005)	234 children tested for tuberculosis	Not stated	8 (0–16) years	48 %
Heuberger et al. (2003)	196	Ex –Yugoslavia > Turkey/Germany > etc.	15–16 years	Not stated
Manzano and Suter (2002)	Asylum seekers $N = ?$	Kosovo > > Bosnia, Somalia, Iraq, Eritrea, Angola, Armenia, Serbia…	0–16 years	Not stated
Mutsch et al. (2006)	Surveillance data 1988–2004	Not stated	0–14 years	Not stated
Hospitalisations				
Schoeni-Affolter et al. (2008)	387,181 Hospital discharge data	Not stated	0–4 years	51 %
Tritschler et al. (2011)	1,005 admitted to intensive care	Western Europe > Balkan > Turkey > Asia > Africa > Eastern Europe > Middle East > Latin America > Northern America	<1 years (40.8 %), 1–5 (22.2 %), 5–10 (14.5 %), 10–15 (14.1 %), >15 (8.5 %)	58 %
Neonatal/congenital/infant				
Bollini and In (2006)	National birth/death register 1997–2001	Mixed	<1 years	Not stated
Merten et al. (2007)	37,332 Routine monitoring data	Mixed	Neonates	Not stated
Poretti et al. (2008)	140 (39 % non-Swiss) Paediatric surveillance system + 4 university maternities	Not stated	Foetus/newborn	40 %, 12 % Not stated
Villadsen et al. (2010)	27,480 deliveries by Turkish mothers; national data 1995–2005	Turkish	Newborns	Not stated
General health				
Depallens Villanueva et al. (2010)	103 undocumented migrants	87 % Latin American	Mean 5.6 years	47 %

Table 2 Health outcomes among paediatric migrants in Switzerland: obesity, dental

Authors	Outcomes	Main conclusion
Obesity		
Bürgi et al. (2010)	BMI (kg/m^2): Swiss, 15.5 ± 1.1; migrant, 15.7 ± 1.5, $p = 0.2$ Skinfold thickness (mm): Swiss, 25.3 ± 5.7; migrant, 27.4 ± 8.9, $p = 0.01$ Percentage overweight/obese children (%) Swiss: 7.0, migrant: 11.0, $p = 0.01$	Possibly more obesity in migrant children
Ebenegger et al. (2011)	Children of migrant compared to non-migrant parent: higher weight (min.1 parent migrant, adj for parental education $p = 0.001$), higher BMI ($p = 0.04$); more time in resting activities ($p = 0.04$); non-overweight to overweight ratio: ($p = 0.01$); adj. for parental education ($p = 0.08$). BMI: No sex difference	Having a parent with migrant background increases odds of being overweight, even when adjusted for parental education
Lasserre et al. (2007)	Overweight (including obesity): 15.0 % (95 %CI 13.7–16.4 %) in boys, 12.4 % (11.1–13.7 %) in girls 1-parent non-Swiss: adj* OR = 1.5 (95 %CI 1.1–2.1) $p = 0.014$, both non-Swiss: adj* OR = 1.9 (95 %CI 1.5–2.4) $p = 0.001$ *for parental education, overweight, residential area etc.	Obesity associated with parental nationality
Ledergerber and Steffen (2011)	Overall adiposity prevalence increasing to 5.4 % and overweight to 20.9 % over several years. Overweight in migrant kindergarden children decreasing	Foreign children 2–3× more likely affected by overweight/obesity
Stettler et al. (2004)	The prevalence of obesity: boys 3.0 %, girls 2.9 %; overweight: boys 11.0 %, girls: 11.2 % Overweight/obesity increased in non-Swiss: OR = 2.16 (95 %CI 1.40–3.33), $p < 0.0001$ non-adj. (adjusted for videogame use, physical activity, television use etc. non sign.	Obesity/overweight associated with foreign nationality
Dental		
Menghini (2008a, b)	Caries-prevalence 7.5 % in CH, 38.5 % in Ex- Yugoslavians 2-year-olds (OR = 7.8; $p < 0.01$) Cavities present in children of Swiss-born mothers: 5 %; foreign-born mothers: 17.4 % (OR 4; $p < 0.001$)	Caries in non-Swiss ×7.8, cavities if mother foreign-born ×4
Menghini et al. (2003b)	In 7–9-year-olds: dmft (caries index) 1.79 in CH, 6.89 in Ex-Yug/Albanian, 3.37 in other migrant children	Caries-prevalence Ex-Yugoslavia/Albania 3× Swiss
Menghini et al. 2003a	Important caries/>=1 molar extracted: Swiss 15 %/2 %, Ex-Yug/Albania: 65 %/16 %	Important Caries/molar extracted: more in Ex-Yug/Albanian
Menghini et al. (2003c)	Ex-Yugoslavian/Albanian more caries (OR = 11 for first, OR = 5.6 for permanent teeth, no CI reported)	Idem

Poretti et al. 2008; Ledergerber and Steffen 2011), some did not report detailed statistics for the paediatric migrants (Menghini et al. 2003a, b, c; Hüsler and Plancherel 2007; Hüsler and Werlen 2010; Mutsch et al. 2006).

Obesity

Five papers based on three studies evaluated the association of migration and obesity. While smaller studies only

Table 3 Health outcomes among paediatric migrants in Switzerland: psychological/social

Authors	Outcomes	Main conclusion
Psychological		
Corigliano et al. (2007)	9/26 children are asylum seekers (6 male, 3 female)	High incidence of psych. urinary frequency in asylum seekers
Hüsler and Werlen (2010); Hüsler and Plancherel (2007)	Swiss and migrants do not differ on depression and anxiety For suicidal tendencies: first generation migrants (1st-Gen) score lowest, Swiss the highest. 1st-Gen score higher on self-esteem. For school achievement 1st-Gen score highest, Swiss lowest. In evasive coping: 1st-Gen higher; in cigarette smoking: Swiss higher, no difference in delinquency	No differences in depression/anxiety for Swiss/non-Swiss; suicidal tendencies higher in Swiss boys, no difference in girls, low socio-economic status related to deliquesce/drug use independent of nationality. More alcohol, cannabis, smoking in Swiss
Steinhausen et al. (2009); Steinhausen and Metzke (2000)	Overall scores on psychosocial test significantly worse ($p < 0.001$) in migrant children (Swiss boys 30.29, girls 31.03; non-Swiss boys 37.2 girls 35.57); Double citizens similar to natives in all domains Perceived maternal rejection (Swiss and double citizens = baseline) OR 1.06 (1.02–1.10) $p = 0.003$; Self-esteem OR 0.97 (0.93–0.99) $p = 0.04$; Self-awareness OR 1.04 (1.01–1.07) $p = 0.01$; Avoidant behaviour OR 1.15 (1.03–1.28) $p = 0.01$; school performance stress OR 0.91 (0.86–0.96) $p < 0.001$. Adolescents from South/South-East Europe most affected. Higher depression scores in girls, cities	Adolescent migrants: sign more internalizing/externalizing problems ($p = 0.05$), aggressive behaviours ($p = 0.05$) anxiety and depression ($p < 0.01$) than Swiss peers; Greater number and more negative impact of life events and adverse psychosocial features No difference in perceived social network/school environment
Abortions		
Narring et al. (2002)	Abortion requests per 1000 adolescents: Non-Swiss: 4.5 (95 %CI 3.8–5.2) Swiss: 2.4 (95 % CI 2.1–2.7)	Foreign adolescents sign more abortion requests
Accidents		
Mayer et al. (2006)	68 % of children admitted to intensive care for falls from windows/balconies have foreign nationality. For other accidents only 12 %	Migrant children at higher risk for falls from buildings
Natterer et al. (2009)	Not stated	No increased risk in the immigrant population
Maltreatment		
Jud et al. (2010)	No difference in maltreatment when controlling for socio-economic status (rough controlling via approximation through residential area characteristic) (no statistics presented)	No difference in maltreatment

found borderline associations between migrant background and overweight/obesity (Ebenegger et al. 2011; Bürgi et al. 2010), those with more power found that migrant children had approximately twice the odds of being obese/overweight compared to their native-born Swiss counterparts, even when socio-economic status was considered (Lasserre et al. 2007; Ledergerber and Steffen 2011) (Table 2).

Dental

Caries have been reported particularly prevalent among ex-Yugoslavian and Albanian children with 38.5—65 % of them being affected by caries compared to 7.5—15 % of their Swiss peers in multiple cross-sectional studies involving dental examinations (Menghini et al. 2003a, b, 2008b) (Table 2).

Psychosocial

Psychological stress and related difficulties seem slightly more common in migrant adolescents compared to the Swiss peers when not including Hüsler's (Hüsler and Plancherel 2007; Hüsler and Werlen 2010) studies on minors in a secondary prevention program for minors psychosocial problems, thus on a group that is unlikely to be representative of the general adolescent population. A school-based study on 1,239 10–17-year-olds (stratified randomised sample considering different school types) using a scoring system found significantly ($p = 0.01$) higher rates of depression and anxiety, an increased sense of maternal rejection in migrant youth [OR 1.06 (1.02–1.10)], especially for those of South-east European origin, but slightly less school-related performance stress [OR 0.9 (0.86–0.96)] (Steinhausen et al. 2009; Steinhausen

Table 4 Health outcomes among paediatric migrants in Switzerland: infectious diseases and general health

Authors	Outcomes	Main conclusion
Infections		
Collet et al. (2005)	Factors significantly associated with a positive Tb-skin test: Tb-contact (OR = 7.31, 95 %CI 2.23–24); increasing age (OR = 1.21, 95 %CI 1.08–1.35); incidence in country of origin (OR = 1.01, 95 %CI 1.00–1.02); Native country (Switzerland/other)(OR = 0.92, 95 %CI 0.17–5.07). BCG vaccination not independent factor (OR = 2.97, 95 %CI 0.91–9.72). Sex: no independent risk factor	Weak association: prevalence of tuberculosis in country of origin with positive test (OR = 1.01, 95 %CI 1.00–1.02)
Heuberger et al. (2003)	*H. pylori* positive (healthy): native born: 7.3 %, foreign born: 30 %; OR = 7.5 (95 %CI 2.4–23.9), $p = 0.0006$	Children/parent born abroad more likely *H. pylori*-pos-serology
Manzano and Suter (2002)	Consultation rates: asylum-seeking/refugee children: 0.99/years, Geneva children 0.3 consultations/years, Tb (13.6 vs. 0.9 %); Microcytic anaemia 6.4 % (Africans 18.2 %) versus 4.2 %; intestinal parasites 38.5 %, symptomatic 4.1 %, rare in local population	Asylum-seeking children use emergency room 3×, are hospitalised 2×; have lower vaccine coverage; higher rates of Tb, microcytic anaemia (esp. Africans), intestinal parasites
Mutsch (2006)	Migrant children at greatest risk to contract Hep A visiting friends/family abroad (data not presented)	Migrant children visiting friends/family at risk to contract Hep. A
Hospitalisations		
Schoeni-Affolter et al. (2008)	66.1 discharges/1,000 children (74/1,000 male, 57,8/1,000 female), mean length of stay 4.77 days Mean discharge rates Swiss 61.2/1,000, non-Swiss 86.6/1,000	Higher hospitalisations rates in non-Swiss compared to Swiss ($p = 0.05$)
Tritschler et al. (2011)	Intensive care (IC): survival after admission: overall 96.7 %, similar for Swiss and non-Swiss IC admissions: 68.3 % Swiss, 31.3 % non-Swiss from a source population with 77.4 % Swiss Immigrant child admitted: 1.12× (95 % CI 1.01–1.25) more likely to be male than Swiss child admitted	Migrant children more often admitted to intensive care ($p < 0.0001$) Similar severity of illness, standardised mortality ratio by nationality, mother tongue and socio-professional status
Neonatal/congenital/infant		
Bollini and In (2006)	Infant mortality (28–365 days): significantly increased in Turkish (2.7/1,000; $p = 0.04$)/African (2.5/1,000: $p = 0.01$) compared to Swiss (1.2/1,000). Others no difference, some better outcomes (Italian: 0.7/1,000) Neonatal mortality Significantly increased in Turkish (4.8/1,000, $p = 0.042$) Africans (5.6/1,000, $p = 0.01$), Italians (4.5/1,000, $p = 0.037$) compared to Swiss (3.4/1,000). Others no sign. difference	Infant and neonatal mortality sign increased in Turkish Neonatal mortality sign increased in Africans and Italians
Merten et al.(2007)	Admittance to neonatal unit (compared to Swiss): African OR = 1.48 (95 %CI 1.19–1.83); Asian OR = 1.45 (95 %CI 1.21–1.73); Admittance to ICU infants from Balkans (OR = 1.30, 95 %CI 1.12–1.52) Sub-Saharan African/Asian mothers: higher proportions of preterm deliveries and multiple births	Increased admittance to neonatal unit (African/Asian neonates) Increased admittance to ICU (infants from Balkans)
Poretti et al. (2008)	Mothers of foetus/babies with neural tube defects: Swiss 59 %, foreign 39 %, rest not determined Most foreign mothers are from southern Europe (mainly Balkans)	Increased risk for neural tube defects in migrants
Villadsen et al. (2010)	Death/1,000: days 0–6: Swiss 3.0, Turkish 3.8; days 7–24 Swiss 0.6, Turkish 0.9	Turkish babies increased mortality: OR = 1.3 (95 %CI 1.1–1.5),
General health		
Depallens Villanueva et al. (2010)	Overall good general health, regular check-ups; High incidence of overweight (27 %)/obesity (13 %)	(No Swiss comparison group)

and Metzke 2000). Asylum seekers were overrepresented in a study of psychologically induced urinary frequency cases (9/29 cases) (Corigliano et al. 2007). Data from the abortion request register in a French-speaking canton suggest that abortion request rates in adolescent migrants were more than twice as high than those of Swiss peers. However, these results were not adjusted for socio-demographic characteristics (Narring et al. 2002). Maltreatment (sexual abuse, negligence, violence etc.) did not differ when adjusted for socio-economic status in a hospital-based cohort (Bradby et al. 2007). A hospital record review of intensive care admissions found that serious injuries through falls from balconies and windows occurred more frequently in migrant (68 % of resulting admissions) than among Swiss children (Mayer et al. 2006). The prevalence of burns was considered similar in migrant and non-migrant children (Natterer et al. 2009) when using the percentage of children without Swiss nationality attending the emergency department as baseline. (Table 3).

Infectious disease

Four studies compared infectious disease patterns between Swiss and non-Swiss children. The included studies examined tuberculosis, intestinal parasites, *H. pylori* infections and Hepatitis A. While Tuberculosis (Tb) primo-infection was found in 13.6 % of asylum-seeking children in Geneva (Manzano and Suter 2002; Collet et al. 2005), Collet et al.—based on a data records review—concluded that the incidence rate in the country of origin was not a significant determination factor for positive Tb-skin-tests. Different test indications—in Swiss this is contact to a Tb-case and in migrants additionally immigration (Collet et al. 2005)—may have contributed to this finding.

Routine screening for intestinal parasites in migrant children consulting at an outpatient migrant health clinic at Geneva's children hospital found intestinal parasites present in 38 % of migrant children, of which 4.1 % were symptomatic—a condition rare in Swiss-born children (Manzano and Suter 2002).

Migrant children were considered a high risk population to contract Hepatitis A in a review of surveillance data on Hepatitis A infections, this due to visits of friends and families abroad (Mutsch et al. 2006). The odds of having an asymptomatic *H. pylori* infection were 7.5 times higher in foreign (30 %) than native-born children (7.3 % point prevalence) screened (Heuberger et al. 2003) (Table 4).

General health

Hospitalisation rates in <5-year-olds were significantly higher in non-Swiss compared to Swiss (86 vs. 61.2 discharges/1,000 minors) using nation-wide hospital discharge data (Schoeni-Affolter et al. 2008) though it is not clear if this finding was confounded by generally higher hospitalisation rates in cities where migrants tend to concentrate. Still, admissions to neonatology (Merten et al. 2007) were nearly 50 % more common for African and Asian neonates. Tritschler et al. report high admission rates for children with foreign origin while outcomes once admitted were the same for Swiss and non-Swiss (Tritschler et al. 2011). Infant mortality rates were twice as high in the African (Bollini and In 2006) and Turkish (Villadsen et al. 2010) babies born in Switzerland as in the Swiss and neonatal mortality particularly increased in African (5.6/1,000), Turkish (4.8/1,000) and Italian (4.5/1,000), neonates compared to the Swiss (3.4/1,000), but adjustment for e.g., consanguinity which had been identified as contributing to a 4–5 times higher hereditary disease-related mortality in Turkish babies in Germany was not done (Bollini and In 2006). The risk of neural tube defects was judged to be increased in babies of migrant mothers who contributed to 39 % of cases, but results may have been affected by recruitment taking place in all paediatric but only obstetric units in four cities, and using the percentage of overall migrant population as a denominator thus not taking into account the higher birth rates (1.8 newborns/non-Swiss woman vs. 1.4 newborns/Swiss woman) in immigrants (Bundesamt für Statistik 2009) (Table 4).

General health of undocumented migrant children ($n = 103$) was considered good in a study in Lausanne (Depallens Villanueva et al. 2010) while health outcomes of asylum-seeking children (Manzano and Suter 2002) in Geneva were marked by doubled hospitalisation and tripled consultation rates compared to the general population. Furthermore, microcytic anaemia was more prevalent (6.4 vs 4.2 %), especially among the African subgroup (18 %) of asylum seekers.

Overall, health outcomes seem similar or worse in migrants than their Swiss peers depending on the health outcome studied.

Discussion

The systematic literature review indicates that migrant children may have certain health needs that differ from their native peers, particularly concerning infectious, congenital or psychosocial aspects of their health.

Some findings among child migrants in Switzerland have been encountered in other settings, such as the association between migrant background and being overweight and obese (Labree et al. 2011), or the increased rates of caries among children from the Balkans in studies from Zurich (Menghini et al. 2003a, b, 2008b) and Germany (Bissar et al. 2007), while others may be more specific for the examined setting.

Considering different stages of migration helps understand the results.

The country of origin

Health of migrant children is influenced by their country of origin, the process of migration, the receiving country and duration of stay. High rates of tuberculosis and intestinal parasites found in paediatric asylum seekers in Geneva (Manzano and Suter 2002) reflect imported health needs linked to different prevalence of disease in countries of origin. International reports of tropical diseases (Moudgil and Kosut 2007), and of increased rates of certain infectious diseases (MacPherson et al. 2006) in migrant children and a different pattern of congenital diseases [e.g., sickle cell disease in African children (Peters et al. 2010)] illustrate, that paediatricians need to consider affections uncommon in central Europe, varying with the country of origin, in migrant children, even if some of these affections have not yet specifically been researched among immigrant children in Switzerland.

Origin also influences health believes, health behaviour and nutrition. Female genital mutilation/cutting is an example for a harmful tradition. Vitamin D deficiency induced by a socio-cultural behaviour in some communities, leading to a lack of sun exposure of the skin, can lead to rickets (Nozza and Rodda 2001). Obviously, culture believes and nutrition practices can also be protective, such as usually consuming meat only well-done in several African communities.

The process of migration

The process of migration may also be a stressor as illustrated by the asylum seekers overrepresented in the study on psychological urinary frequency (Corigliano et al. 2007). Separation from mothers during the process of migration has been identified as a risk factor for abuse (Ferrier et al. 1985). This should be considered in children left behind joining their families.

In the host country

Psychosocial stress may continue in the host country, e.g. through bullying due to insufficient language proficiency (von Grunigen et al. 2010). An increase in psychological problems as suggested in this review (Steinhausen et al. 2009) and the higher prevalence of depression in migrant adolescents is not surprising as some adolescents may be torn between two cultures. International research on paediatric migrant mental health is not conclusively reflecting the wide range of influencing factors: in the UK paediatric migrants of certain countries of origin have better outcomes than natives which have been considered due to culture and protective family structures (Goodman et al. 2008) whereas migrant youth have higher rates of psychological problems than German peers (Holling et al. 2008).

Such international comparison is complex as the host country may also influence health of migrant children. Different countries may attract different migrant populations and provide them with different care. While countries like Switzerland have achieved universal coverage and reduced access barriers even for illegal migrants offering them health insurance and protection from reporting through health insurance companies and health providers (Bilger and Hollomey 2011), some immigrant groups e.g., in the US, face important legal and financial access barriers to health care (Huang et al. 2006). Comparison is further complicated when studies fail to distinguish the migrant population concerned, possibly masking health needs of subgroups. Needs may vary considerably according to the country of origin and social status in the host country. A child originating from a neighbouring country is more likely to have a very similar risk factor and health need pattern as a native peer while a freshly immigrated child from South East Asia, Africa or Latin America may more likely still be suffering from a tropical disease uncommon in a Western host country. Health needs of every child need to be evaluated individually, taking its background fully into account, nationality and migrant background just being indicators for potential vulnerability and specific needs.

The increased hospitalisation rates in immigrant children in Switzerland (Schoeni-Affolter et al. 2008) warrant further examination as it is unclear whether it represents worse health or are due to other factors, such as hospitalisations when communication is inadequate to guarantee home-based care. The increased infant mortality rates in Africans (Bollini and In 2006) and higher rates of admittance to intensive care (Tritschler et al. 2011) may reflect a failure to provide or seek care at earlier stages.

Limitations

There are several important limitations to the findings of this review. As paediatric migrant health is influenced by the country of origin, the process of migration, the host country (disease prevalence, social status and health care system) and duration of stay, presented findings can only claim relevant for the examined settings and migrant population. Most studies identified in this search are confined to a specific location within Switzerland, reflecting the local migrant background mix which is not necessarily representative for the entire country. As migration status often was not the main research question, quality of some results may have been compromised e.g., when no

adjusting for additional confounders such as social status was undertaken (Ledergerber and Steffen 2011; Bollini and In 2006; Poretti et al. 2008; Narring et al. 2002). Most studies did not report results separate for gender or different nationalities. Furthermore hospital-based studies, e.g. on maltreatment, may be biased by referral practices. Selection criteria varied between studies with some studies considering parental country of origin and others nationality to define a migrant child. Whenever nationality is used, needs of migrant background children may not be detected. Such methodological difficulties imply that results are not necessarily representative of migrant paediatric health conditions and that e.g. needs of smaller subgroups may have been unrecognised.

The systematic literature review could only identify research publically available using the outlined search strategy and cannot claim to cover all health concerns. Through citation chasing, gray literature searches and inclusion of research in three national languages besides English, we have tried to reduce international publication bias. Unpublished clinical experiences may have indicated further concerns.

Implications for public health, paediatric care and research

Regarding the various health needs presented, it is clear that paediatric care needs to be aware of the disease patterns and risk factors linked to migration to avoid inducing additional costs and suffering through delayed diagnoses. International guidelines (The Royal Children's Hospital Melbourne (The Royal Children's Hospital Melbourne 2011); Levenson and Sharma 1999) focus on newly arrived refugee children. The old Swiss recommendations from 1996 focus on a previous border exam of asylum-seeking children (Tabin et al. 1996). Adapted guidelines may be useful also for non-refugees. Paediatric bodies should offer courses on paediatric migrant health issues, establish a migrant health working group to promote activities and adapt existing international migrant paediatric health guideline and liaise internationally.

There are still important information gaps. Research should recognise different migrant groups to enhance comparability across settings and avoiding masking of potential health needs. Only using the child's nationality may not be sufficient to detect health risks linked to a family history of migration. Furthermore influencing factors such as duration of stay, language skills, parental education and socio-economic factors need to be considered. The different parental influences on migrant child health in mixed nationality couples may also be worth investigating.

Various health risks identified by research such as obesity and poor dental hygiene are potentially accessible by health promotion activities. They should be addressed by targeted health prevention programs to reduce long-term costs and morbidity. Physical and mental wellbeing in childhood and adolescents are central for proper development and education. Paying attention to migrant children's health may therefore contribute to helping them become successful members of society and impact health in adulthood positively.

Conclusion

The systematic literature review reveals that migrant children—depending on their origin and the experienced process of migration—may have certain health needs different to their native peers. As the systematic review and international literature indicate, these are not solely confined to infectious diseases but include psychosocial, congenital and health belief concerns. Paediatricians and public health planners need to consider various aspects linked to migration and migrant background and to provide trans-culturally appropriate care for migrant minors. This combination can be called "migrant paediatrics". It underlines that recognising the importance of good health of migrant children may contribute to better overall population health.

Acknowledgments We would like to thank FAG, Freiwillige Akademische Gesellschaft Basel, Switzerland, for supporting the study (FNJ).

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