Brief communication:

Paediatric asthma hospitalisations continue to decrease in Finland and Sweden between 2015 and 2020

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Abbreviations:

CI	Confidence intervals
ICD-10	International Disease Classification, 10th Revision
IRR	incidence rate ratio

Abstract

We previously reported a decreasing incidence of paediatric asthma hospitalisations in Finland, but a rather stable trend in Sweden, between 2005-2014. We now aimed to investigate the incidence of paediatric asthma hospitalisations in these countries between 2015-2020, using Finland's National Hospital Discharge Register and Sweden's National Patient Register, which cover all hospitalisations in the respective countries. From 2015-2019, the incidence of paediatric asthma hospitalisations decreased by 36.7% in Finland and 39.9% in Sweden and are increasingly approaching parity. In 2020, despite differences in COVID-19-related restrictions, asthma hospitalisations decreased by over 40%, thus warranting future research on the subject.

Introduction

Asthma is one of the most prevalent chronic diseases worldwide, albeit with decreasing trends in asthma hospitalisations, which may be partly attributable to improved medication and healthcare.[1-3] We previously reported a decreasing incidence of paediatric asthma hospitalisations in Finland, but a stable trend in Sweden, between 2005-2014.[4] Reasons for the differences between these neighbouring countries remain incompletely understood. Since that time, the incidence of asthma hospitalisations has been understudied, yet warrants consideration particularly given the different COVID-19 strategies in these two countries. Thus, we aimed to investigate the incidence of paediatric asthma hospitalisations in Finland and Sweden from 2015-2020, including consideration to differences in hospitalisations before vs. during the COVID-19 pandemic.

Methods

This study makes use of data from Finland's National Hospital Discharge Register and Sweden's National Patient Register, of which both detail nationwide inpatient hospital data including age, time of hospitalisation and diagnosis in the respective countries.

Children aged 0-19 years hospitalised with a primary diagnosis of asthma from 2015-2020 were identified by computer searches using the International Classification of Diseases, 10th Revision (ICD-10) codes. Our primary outcome was the number of hospitalisations among paediatric population with a primary diagnosis of asthma and corresponding ICD-10 codes: J45 (asthma) and J46 (status asthmaticus). Consideration was given to sex and age groups (0-4, 5-9, 10-14 and 15-19 years). As hospitalisations due to bronchiolitis may be a confounding factor, we also performed separate search for code J21 (acute bronchiolitis). As wheeze due to viral infections may be miscoded as asthma in young children, we additionally examined "small wheezers" by considering a combined code of J45-J46 and J21 amongst children aged 0-4 years.

We hypothesized that compared to before the COVID-19 pandemic (i.e. 2015-2019), hospitalisations would be lower during the pandemic (i.e. 2020).

As the data were retrieved from aggregate databases from Finnish and Swedish authorities, ethical approval was not possible or necessary.

To compute the incidence of asthma hospitalisations, the annual age-specific mid-populations were obtained from Official Statistics of Finland and Statistics Sweden. The incidence of hospitalisations (per 10,000 person-years) was based on the results of the entire population of children in each country.

Poisson regression was used in analysis, with results reported as incidence rate ratios (IRR) and corresponding 95% confidence intervals (95%CI). Statistical analyses were performed with Stata 13.0 (StataCorp, College Station, TX, USA).

Results

From 2015-2020, paediatric asthma hospitalisations totaled 7,101 in Finland and 10,042 in Sweden. From 2015-2019 (i.e. pre-COVID), the incidence of asthma hospitalisations decreased by 36.7% in Finland and 39.9% in Sweden, from 6.0 per 10,000 person-years in 2015, to 3.8 in 2019 in Finland (IRR 0.90, 95% CI 0.88-0.92) and, from 10.1 to 6.1 in Sweden (IRR 0.87, 95% CI 0.85-0.88). In 2020 (i.e. the first pandemic year), the incidence of asthma hospitalisations decreased 47.4% in Finland and 42.7% in Sweden compared to 2019 (Figure 1 Panel A). In both countries, disproportionately more males were hospitalised (Finland: 61.2%; Sweden 62.0%).

With consideration to age, children aged 0-4 years accounted for 46.0% of all asthma hospitalisations in Finland and 77.8% in Sweden. Yet, asthma hospitalisations decreased over time amongst children aged 0-4 years, from 15.4 per 10,000 person-years (2015) to 9.4 per 10,000 (2019) person-years in Finland and from 33.4 to 20.3 in Sweden, corresponding to a decrease of 39.0% in both countries. Across other age groups, trends in the incidence of hospitalisations were less clear (Figure 1, Panels B and C).

From 2015-2020, acute bronchiolitis hospitalisations for children aged 0-4 years totaled 20,217 in Finland and 7,807 in Sweden. The incidence of hospitalisations with this code was stable over time in both countries during 2015-2019 among children aged 0-4 years, although the incidence in Finland (120.0-135.7/10,000 person-years) was notably higher than in Sweden (36.1-47.5/10,000 person-years). In this age group, the incidence of hospitalisations for “small wheezers” was stable in

both countries. In 2020, the incidence of hospitalisations for this age group decreased 31.7% in Finland and 61.9% in Sweden, compared to previous years (Figure 2).

Discussion

In this study based on national-level hospitalisation data in Finland and Sweden, the incidence of paediatric asthma hospitalisations decreased by 36.7% in Finland and 39.9% in Sweden, between 2015-2019. In 2020, asthma hospitalisations in both countries were over 40% lower compared to the previous year. The overall decrease in hospitalisations in both countries was largely attributable to fewer admissions of children aged 0-4 years, who represented the majority of patients. Over the study period, the incidence of hospital admissions due to wheezing was higher in Finland than in Sweden.

Our study has some limitations. As data were based on ICD-codes and hospitalisation statistics, consideration to treatments given in the emergency department, or patient outcomes following discharge was not possible. Moreover, we cannot be certain if there were inter-country differences in diagnosing asthma, although asthma care in the two countries is regarded very similar.

Nonetheless, our findings are novel, as they describe the national trends of paediatric asthma hospitalisations from 2015-2020 in two well-defined, neighbouring populations with different COVID-19 strategies. We highlight the use of national level hospitalisation data from validated and well-established registers,[5 6] and the use of standardised ICD-10 diagnostic coding, which permitted estimations of incidence and an international comparison.

Globally, paediatric asthma hospitalisations have decreased.[2 7 8] Prior to 2015, the incidence of paediatric asthma hospitalisations was notably lower in Finland than

Sweden.[9] However, our findings indicate that the incidences of asthma hospitalisations are approaching parity. As the trend of incidences of wheeze-related hospital admissions was stable in both countries 2015-2019, the changes in paediatric asthma hospitalisation likely do not reflect changes in coding (e.g. from asthma to wheezing). Notably, the incidence of hospital admissions due to wheezing was higher in Finland compared to Sweden. We speculate that "small wheezers" may be more commonly admitted to hospital in Finland, whereas such patients may be treated in Swedish outpatient clinics and emergency departments. One reason for this difference might be more comprehensive primary health care in Sweden compared to Finland (https://www.oecd.org/health/bycountry/).

The COVID-19 pandemic has decreased paediatric emergency visits[10] which may explain the observed change in asthma hospitalisations in Finland and Sweden. Although Sweden had fewer COVID-related restrictions than Finland, the decreases in paediatric asthma hospitalisations and "small wheezers" were comparable. [10]

We speculate that intensive and comprehensive pediatric asthma care in Finland and Sweden may have contributed to the declining trend in asthma hospitalisations. [11] The Finnish Allergy Programme, which existed between 2008-2018, may be attributable for this progress in Finland and similar improvements have been launched later in Sweden as well which may have resulted to less asthma hospitalisations among children. [12]

In conclusion, asthma hospitalisations among Finnish and Swedish children decreased during 2015-2020, and are approaching parity. Despite differences in

COVID-19-related restrictions, asthma hospitalisations decreased by over 40% in 2020.

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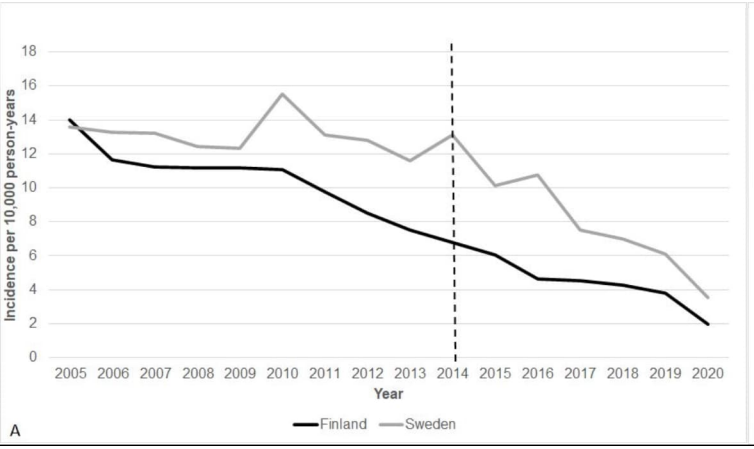
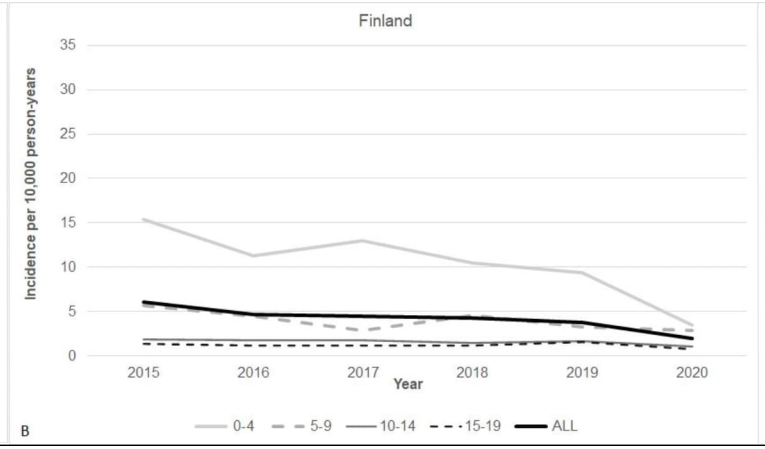
Figure legends

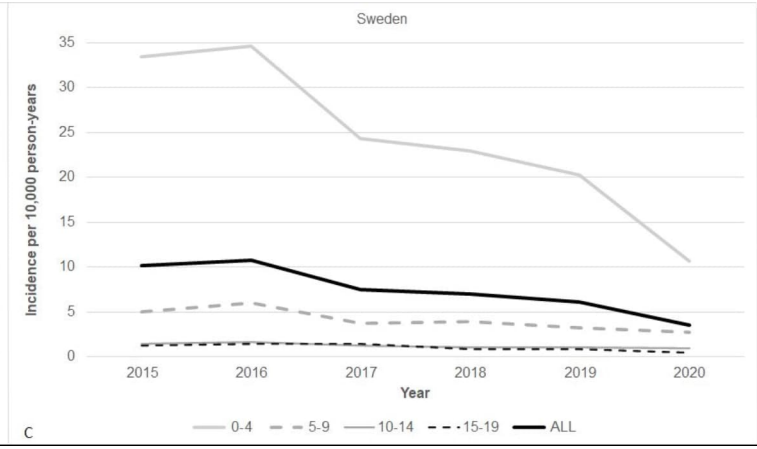
Figure 1. Incidence of hospitalisations for asthma per 10,000 person-years among Finnish and Swedish children (aged 0–19 years) between 2015 and 2020.

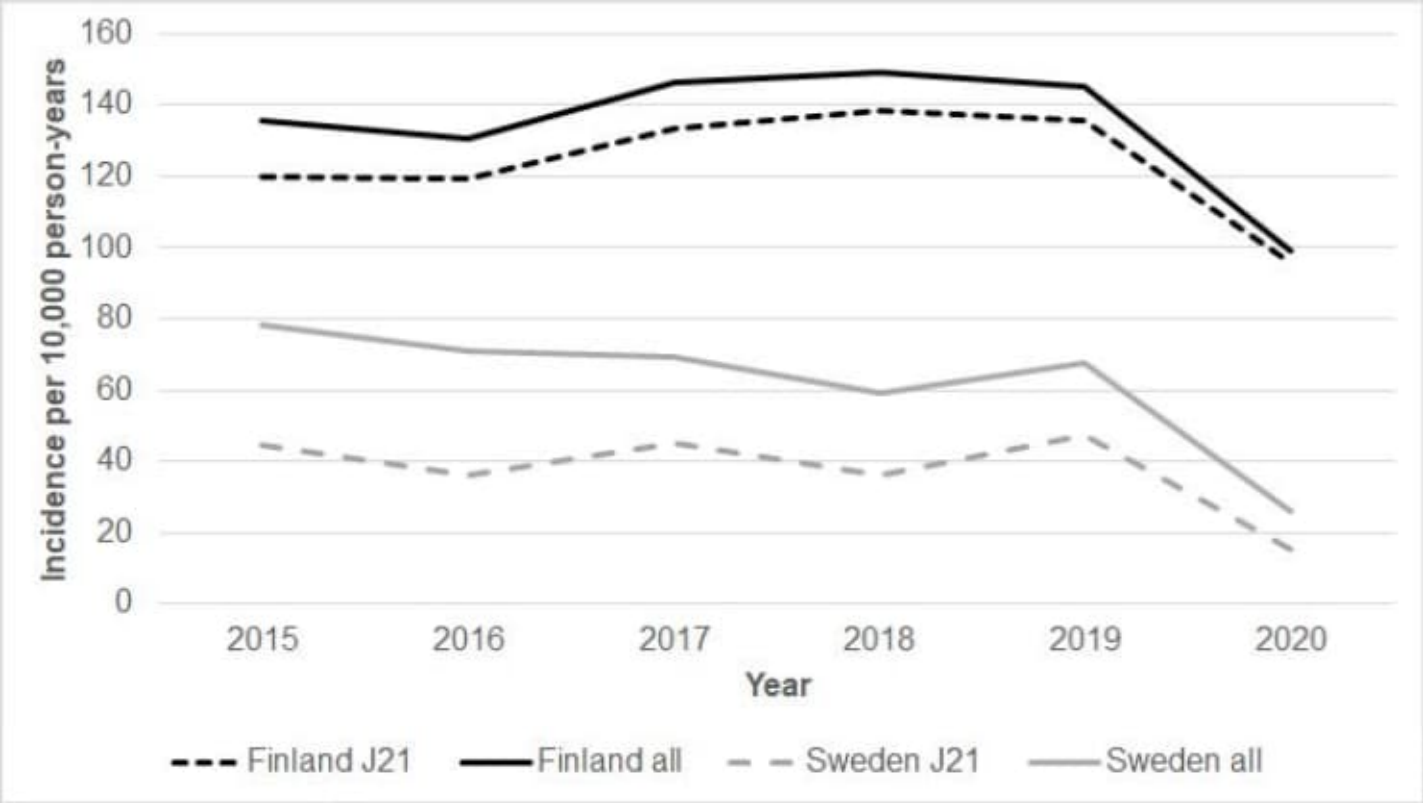
a. Finland and Sweden (including earlier published incidences 2005-2014).[4]
b. Finland: age groups and total.
c. Sweden: age groups and total.

Figure 2. Incidence of hospitalisations for small wheezers per 10,000 person-years among Finnish and Swedish children (aged 0–4 years) between 2015 and 2020 (all=combined diagnosis J21 and J45–J46).


Incidence per 10,000 person-years
18
16
14
12
10
8
6
4
2
0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Year
Finland
Sweden
A


Finland
Incidence per 10,000 person-years
35
30
25
20
15
10
5
0
2015 2016 2017 2018 2019 2020
Year
0-4
5-9
10-14
15-19
ALL
B


Sweden
Incidence per 10,000 person-years
35
30
25
20
15
10
5
0
2015 2016 2017 2018 2019 2020
Year
0-4
5-9
10-14
15-19
ALL
C


160
140
120
100
80
60
40
20
0
Incidence per 10,000 person-years
2015
2016
2017
2018
2019
2020
Year
Finland J21
Finland all
Sweden J21
Sweden all