International Journal of Infectious Diseases 166 (2026) 108502

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Review

Invasive meningococcal disease rebound in older adults post-COVID-19 pandemic: A targeted literature and surveillance review

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ARTICLE INFO

Article history:
Received 27 January 2026
Accepted 23 February 2026

Keywords:
Invasive meningococcal disease
Older adults
Re-emergence
COVID-19 pandemic
Case fatality rate
Epidemiology

ABSTRACT

Objectives: Invasive meningococcal disease (IMD), caused by *Neisseria meningitidis*, remains a significant public health concern due to its rapid progression, high case fatality rate (CFR), and evolving epidemiology. Recent trends suggest a demographic shift toward older adults. This review examined post-COVID-19 changes in IMD epidemiology among adults aged ≥65 years, including regional variations, serogroup distribution, and mortality.

Methods: A targeted literature review was conducted using OVID (Embase, MEDLINE) following PICOS-T criteria, including full-text English-language studies published between January 2021 and June 2024, supplemented by surveillance reports.

Results: Of 1639 records screened, four peer-reviewed publications and ten surveillance reports met inclusion criteria. During the COVID-19 pandemic, IMD incidence declined sharply across all age groups, including older adults. Post-pandemic data indicate a re-emergence of IMD among older populations, with incidence in several regions returning to or exceeding pre-pandemic levels by 2023. Across multiple locations, serogroup Y emerged as the dominant or increasingly prevalent serogroup among older adults. CFR varied by region and serogroup and consistently remained high in this age group.

Conclusion: These findings demonstrate the re-emergence of IMD among older adults and highlight the need for strengthened IMD surveillance and serogroup monitoring in this population, to guide prevention strategies and inform public health policy.

Introduction

Invasive meningococcal disease (IMD) is a severe, rapidly progressing illness caused by the Gram-negative bacterium *Neisseria meningitidis*. It can result in life-threatening conditions such as meningitis and septicemia and is associated with high morbidity and mortality, even with appropriate medical treatment [1,2]. Survivors often endure life-term sequelae, including disfigurement, cognitive impairment, psychological disorders, limb amputations, and hearing or vision impairments [3,4]. Despite advances in medical care, case fatality rates (CFRs) remain high, ranging from 4.1% to 20% [2,4,5].

Abbreviations: CFR, case fatality rate; EEA, European Economic Area; EU, European Union; IMD, invasive meningococcal disease; NIP, national immunization program; NPI, nonpharmaceutical intervention; PICOS-T, Population, Intervention, Comparator, Outcomes, Study design/setting, and Timeframe; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; TLR, targeted literature review.

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https://doi.org/10.1016/j.ijid.2026.108502

Of the 12 capsular serogroups, six (A, B, C, W, X, and Y) account for the majority of IMD cases worldwide. The epidemiological patterns of these serogroups are characterized by considerable variability and unpredictability, influenced by temporal trends, geographical distribution, and age demographics [5–7]. Globally, the annual incidence of IMD can range from very rare to as high as 1000 cases per 100,000 individuals. IMD can occur as an endemic disease marked by sporadic cases or may present as epidemic outbreaks [1,2,4]. Although IMD affects individuals across the entire age spectrum, its epidemiological burden varies across different age groups. The highest incidence is consistently observed in infants, followed by a secondary peak among adolescents and young adults. Notably, recent epidemiological studies have identified a tertiary peak in older adults, suggesting a shifting age-related disease pattern [4,7]. Additionally, the absolute number of IMD cases has been observed to be higher among older adults, particularly in Europe and North America [4,8]. The estimated overall CFRs of IMD exhibit significant variation across different age groups, with the highest rates observed in older adults, probably linked to underlying comorbidities and more atypical presentations hindering timely diagnosis and treatment [4,9].

The global landscape of IMD changed significantly during the COVID-19 pandemic due to the implementation of nonpharmaceutical interventions, such as reduced social contact, physical distancing, mask wearing, and hand-hygiene practices. These measures, along with national and regional lockdowns, aimed at controlling the spread of SARS-CoV-2, led to a decline in respiratory transmissible infections, including IMD [10]. However, a rebound of IMD incidence was reported as starting from the second half of 2021, with various degrees across different regions/countries [11]. A reduced meningococcal vaccine uptake during the COVID-19 pandemic may have exacerbated the decline in anti-meningococcal immunity also known as “immunity debt” or “immunity gap” [10,11].

This targeted literature review (TLR) was undertaken to comprehensively examine the epidemiological changes in IMD among older adults (aged ≥65 years) after the post-COVID-19 period. Specifically, it aims to assess trends in disease incidence, CFRs, and serogroup distribution following the relaxation of pandemic-related containment measures. Given the heightened vulnerability of older populations and the potential shifts in disease dynamics due to post-pandemic changes in healthcare access, pathogen circulation, and population immunity, this review seeks to provide critical insights into the evolving burden of IMD in older adults.

Methods

This TLR was conducted and reported in accordance with key principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines that ensure a comprehensive and structured approach to the review process [12].

Search strategy and data sources

A comprehensive literature search was conducted across MEDLINE and EMBASE via the OVID platform to identify studies reporting on the epidemiology of IMD by age group during and after the COVID-19 pandemic. English-language search terms related to “meningococcal disease” and “COVID-19” OR “meningococcal disease” and “epidemiology, incidence, outbreak” were used to capture studies published between January 1, 2021 and June 17, 2024, focusing on IMD incidence, CFRs, and serogroup distribution. While the primary emphasis was on post-pandemic trends, we also report pre-pandemic data (2015-2019) for contextual comparison. A supplementary gray literature search was conducted to retrieve national and regional surveillance data published online up to June 1, 2025.

Article selection

Duplicates were removed, and unique records were screened by one reviewer using predefined criteria; inclusion decisions were independently verified based on the PICOS-T (Population, Intervention, Comparator, Outcomes, Study design, and Time) framework. Case reports, series, and conference abstracts were excluded due to their inherently low quality of evidence (Supplementary Table S1). The selection process is illustrated in Supplementary Figure S1 using a PRISMA flow diagram that outlines the reasons for exclusions at both abstract and full-text screening stages.

Data synthesis

From eligible published articles and surveillance reports, the relevant data reported in text, tables, and figures were extracted. Wherever the relevant data were available only in figures, the data were digitized using a free web-based tool (WebPlotDigitizer 4.8; https://apps.automeris.io/wpd4/).

To assess the impact of COVID-19 pandemic on IMD epidemiology, data were categorized into three periods: pre-pandemic (2015-2019), pandemic (2020-2021), and post-pandemic (2022 onward). This classification reflects the time when changes in public health measures and social behavior occurred.

Results

A search through peer-reviewed literature identified a total of 1639 articles, of which 489 were duplicates (Supplementary Figure S1). A total of 1104 records were excluded based on criteria such as article type, population relevance, study design, outcome focus, and timeframe, resulting in 46 articles for full-text screening. Of the 46 full-text articles assessed, 42 were excluded as they either lacked data relevant to the study objectives or did not meet the age-related inclusion criteria. A total of four articles from England (1), France (1), and Poland (2) were included in this TLR [7,13–15].

Furthermore, a total of 10 IMD surveillance reports or data extractions from web-based portals from nine countries (England, France, Spain, Italy, Germany, the Netherlands, the United States, Canada, and Australia) and one region (European Union/European Economic Area [EU/EEA]) were also included (Supplementary Table S2) [8,16–38]. Considering the inconsistent age cut-off for older adults across the countries and published literature/surveillance reports, the existing stratification was adhered to and the data were reported as published. Table 1 summarizes the characteristics of the included sources.

IMD incidence in older adults

Several studies and surveillance data showed that the incidence rate of IMD in older adults decreased during the pandemic and rebounded markedly afterward. Concurrently, the proportion of IMD cases occurring in older adults also decreased during the pandemic and then increased in the post-pandemic period in many countries (Supplementary Table S3).

IMD incidence and proportion of IMD cases in older adults by country or region

The trends in the incidence of IMD among older adults have varied across countries over time. Prior to the COVID-19 pandemic (2015-2019), the incidence remained rather stable in Italy and Germany, increased in the United States and Spain, declined sharply in England, and showed mixed patterns in Australia, the Netherlands, and France. During the pandemic period (2019-2021), all countries experienced a significant decline in the incidence of IMD

Table 1
Characteristics of all the included articles and surveillance reports

Reference	Country	Data collection period	Data type	Population	Age category (Range)	Data source
Europe ($n = 11$)						
Surveillance reports—EU/EEA	Europe (30 countries)	2015-22 [Jan to Dec]	Population-based surveillance system	Patients with IMD	All (Age: 0-≥65 y)	The European Surveillance System
Surveillance report—France	France	2015-23 [Jan to Dec & Jul to Jun for some analyses]	Population-based surveillance system	Patients with IMD	All (Age: <1-≥80 y)	Regional Health Agencies. Santé Publique France. Centre National de Reference (Institut Pasteur)
Surveillance report—Spain	Spain	2015-23 [Jul to Jun]	Population-based surveillance system	Patients with IMD	All (Age: 0-≥65 y)	Public Health Surveillance—RENAVE
Surveillance report—Germany	Germany	2015-24 [Jan to Dec]	Population-based surveillance system	Patients with IMD	All (Age: <1-≥79 y)	Robert Koch Institute datasets
Surveillance report—Italy	Italy	2015-23 [Jan to Dec]	Population-based surveillance system	Patients with IMD	All (Age: 0->64 y)	Infectious Diseases Department of the Instituto Superiore di Sanità
Surveillance report—England	England	2015-23 [Jul to Jun]	Population-based surveillance system	Patients with IMD	All (Age: <1-≥65 y)	UK Health Security Agency
Taha et al.	France	2015-23 [Jan to Dec]	Retrospective descriptive study	Patients with IMD	NR (Age: <1-≥65 y)	National Reference Center for meningococcal and *Haemophilus influenza*
Clark et al.	England	2017-23 [Apr to Mar]	Observational	Patients with suspected IMD	All (Age: <1-≥65 y)	UK Health Security Agency
Mrozowska-Nyckowska et al.	Poland	2021-22 [Jan to Dec]	Observational	Patients with infections	All (Age: 0-≥65 y)	NIPH NIH–NRI by Voivodeship Sanitary and Epidemiological Stations and EpiBase electronic system
Surveillance report—Netherlands	The Netherlands	2015-23 [Jan to Dec]	Population-based surveillance system	Patients with IMD	All (Age: 0-≥50 y)	National Institute for Public Health and the Environment. RIVM.
North America ($n = 2$)						
Surveillance reports—United States	United States	2015-23 [Jan to Dec]	Population-based surveillance system	ABCs network	All (Age: 0-≥65 y)	US Centre for Disease Control and Prevention
Surveillance reports—Canada	Canada	2015-22 [Jan to Dec]	Population-based surveillance system	Patients with IMD	All (Age: 0-≥60 y)	National Enhanced Invasive Meningococcal Disease Surveillance System
Australia ($n = 1$)						
Surveillance reports—Australia	Australia	2015-23 [Jan to Dec]	Population-based surveillance system	Patients with IMD	All (Age: 0-85+ *y*)	National Notifiable Disease Surveillance System

ABCs: Active Bacterial Core surveillance; ECDC: European Centre for Disease Prevention and Control; EEA: European Economic Area; EU: European Union; IMD: invasive meningococcal disease; NIH: National Institute of Hygiene; NIPH: National Institute of Public Health; NRI: National Research Institute; RENAVE: Red Nacional de Vigilancia Epidemiológica; UK: United Kingdom; y: year.

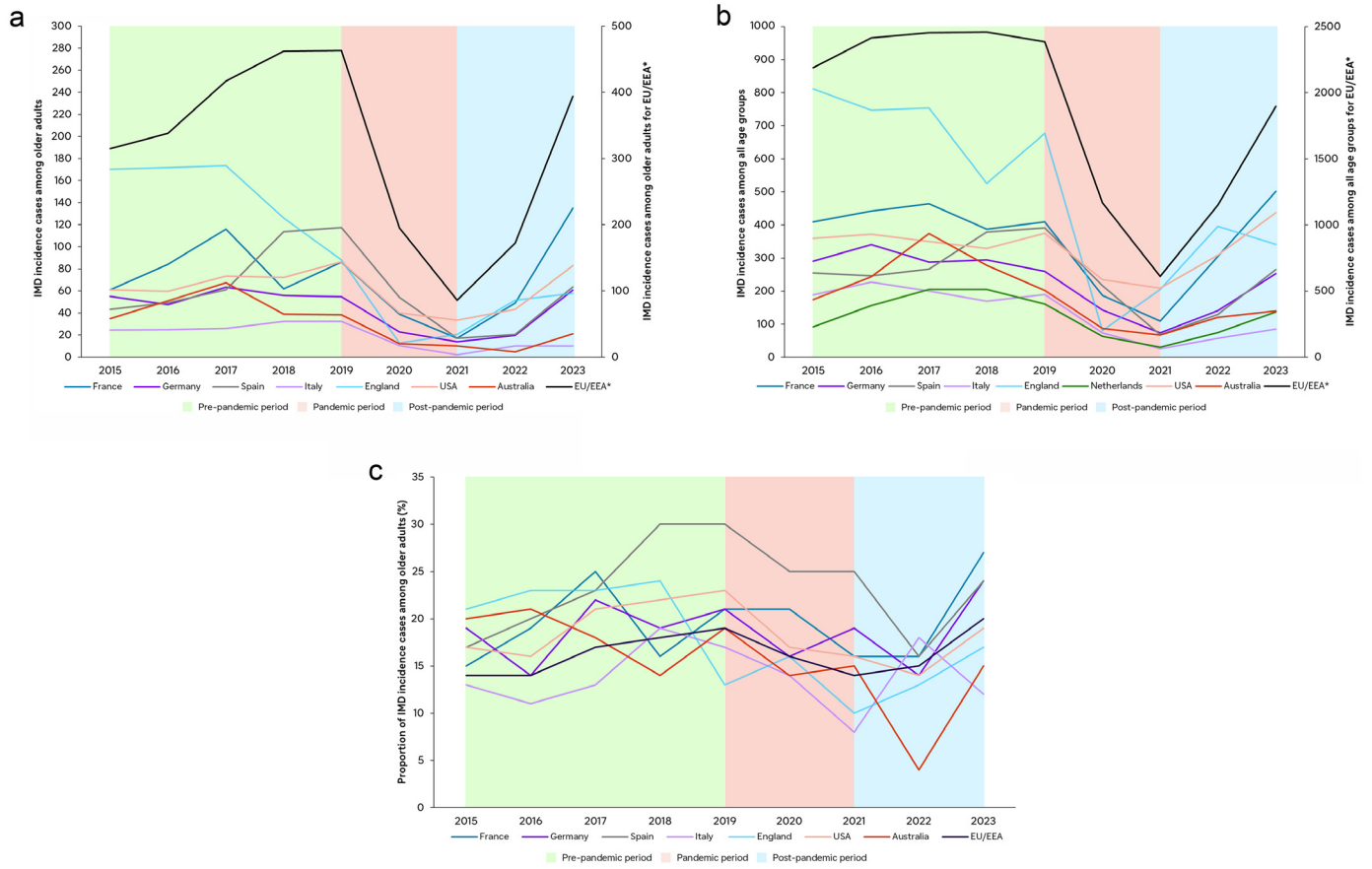

Figure 1. Invasive meningococcal disease (IMD) incidence cases during the period of 2015-2023. a. Number of cases in older adults (aged ≥65 years); b. Total number of cases among all age groups; c. Proportion of cases among older adults (aged ≥65 years).
*The data for the EU/EEA region are plotted on the secondary axis due to the significantly high number of incidence cases, which resulted from aggregated reporting.
EEA: European Economic Area; EU: European Union; USA: United States of America.

(Figure 1a) among older adults, followed by a rebound in the post-pandemic period, with England showing an earlier resurgence beginning in 2020. The most pronounced rebound occurred in France, where the incidence surpassed the pre-pandemic levels by 2023. In contrast, the incidence in the United States and Australia approached but did not exceed the pre-pandemic levels, whereas in other countries, it remained below those levels (Supplementary Table S3 and Figure 1a).

Europe

In the EU/EEA area, between 2015 and 2019, the incidence of IMD cases in adults aged ≥65 years increased from 315 to 463. In parallel, the proportion of IMD cases in individuals aged ≥65 years increased from 14% to 19%. Then, followed a temporary decline in IMD incidence was observed during the COVID-19 pandemic period (2020-2021), followed by a post-pandemic increase, with older adults accounting for 20% of all reported IMD cases in 2023, surpassing the pre-pandemic levels [19].

Of note, the total number of IMD cases reported in this region showed a steady increase from 2015 through 2018. However, after the COVID-19 pandemic, the number of cases did not rise back to these pre-pandemic levels [16–19] (Figure 1b).

In France, the incidence of IMD among older adults (aged ≥65 years) showed a mixed pattern during the pre-pandemic period (2015-2019), with an initial increase followed by a decline toward the end of the period. A marked decline in incidence was observed during the pandemic years (2019-2021), followed by a sharp rebound from 2022 onward, when the number of IMD cases in older adults nearly tripled from 49 in 2021 to 135 in 2023, exceeding pre-pandemic levels (Figure 1a). These trends mirrored those observed in the overall population, as a total number of 501 cases were reported in 2023 compared to 409 in 2019 [13] (Figure 1b). The proportion of IMD cases among older adults, ranging from 15% to 25% before the COVID-19 pandemic, reached 27% of all reported cases in 2023 [20–22] (Figure 1c).

Clark *et al.* [7] reported findings from England, based on the surveillance data collected between April 2017 and March 2023. Due to the April–March reporting cycle, the year 2021/22 is considered part of the pandemic period. IMD incidence among older adults (≥65 years) increased until 2017 to 172 cases, followed by a decline in 2018 and 2019 that became even more pronounced during the pandemic. The rebound observed thereafter did not exceed pre-pandemic levels, with 57 cases in 2023/24 (Figure 1a). The proportion of IMD cases among older adults increased to 17% in 2023/24, without reaching the range of 21-24% that was observed before 2020 (Figure 1c). Overall, the number of cases decreased during the pre-pandemic period, dropped to 80 cases in 2020, and then, nearly doubled from 205 in 2021/22 to 396 in 2022/23, far surpassing the 80 cases recorded in 2020/21 but remained far below the levels reached before the pandemic [27].

In Spain, after a substantial increase in the incidence of IMD among older adults (aged ≥65 years) throughout the pre-pandemic years, a marked decline was observed during the pandemic, followed by a rebound in 2023 (63 cases) that did not exceed the pre-pandemic level (119 cases) (Figure 1a) [23]. The same pattern was observed with the overall incidence of IMD (Figure 1b). The proportion of cases among older adults reached 30% in 2018 and 2019, 25% in 2020 and 2021, and 24% in 2023.

In Germany, the incidence of IMD among older adults (aged ≥65 years) ranged from 49 to 62 cases before the pandemic, decreased to 14 cases in 2021 but rebounded to 63 cases in 2023 (Figure 1a). In Germany, the year 2022 confirmed the post-pandemic rebound in the number of IMD cases across all age groups [24]. By 2023, the proportion of older adult cases surged to 24%, exceeding the pre-pandemic levels (Supplementary Table S3).

In Italy, the incidence of IMD among older adults (aged ≥65 years) remained rather stable until 2019, decreased to only two cases in 2021, and again increased to 10 cases in 2022 and 2023, which was one-third of the pre-pandemic levels (Figure 1a). Concurrently, the total number of IMD cases peaked at 190 in 2019, decreased dramatically to 26 in 2021, and then increased again to 85 in 2022 (Figure 1b). The proportion of IMD cases among older adults was slightly rising before the COVID-19 pandemic, reaching 19% in 2018. Afterward, this percentage decreased slightly to 18% in 2022 and then to 12% in 2023 [25,26] (Supplementary Table S3 and Figure 1c).

Two peer-reviewed studies from Poland reported that older adults (≥65 years) experienced a rebound in the incidence, reaching 0.08 per 100,000 population in 2022. This was preceded by a decline during the pandemic years, with the incidence decreasing to 0.03 in 2020 and further to 0.01 in 2021 [14,15].

In the Netherlands, the incidence of IMD cases in adults aged ≥50 years—using this available age cut-off—increased from 33 in 2015 to 67 in 2019 and markedly decreased during the pandemic years. The rebound observed in 2023 did not reach the pre-pandemic levels. This trend mirrored the one observed for overall number of IMD cases [18,28] (Figure 1c). The proportion of adults aged ≥50 years accounted for 24% of total IMD cases in 2023, which was lower than that in the pre-pandemic period, peaked at 47% in 2018 [18].

United States

Following an increase in the incidence of IMD among older adults (aged ≥65 years) throughout the pre-pandemic years and a marked drop during the pandemic, a rebound was observed in 2023 with 84 cases reported, which did not exceed the number of cases in the pre-pandemic period (88 cases in 2019). Overall, cases of IMD were progressively decreasing before the pandemic, with a marked decrease during the pandemic. The number of cases increased sharply post 2021 but did not exceed the pre-pandemic levels as of 2023 (Figure 1b). The proportion of IMD cases among older adults continuously increased before the pandemic to reach 23% in 2019 (88 cases), dropped to 14% during the pandemic years, and then increased to 19% (84 cases) in 2023 [29–34] (Supplementary Table S3 and Figure 1c).

Canada

The surveillance data from 2015 to 2022 indicated that the incidence rate of IMD in older adults (aged ≥60 years, available age cut-off) increased to 0.52 per 100,000 until 2018, declined during the pandemic to 0.06 per 100,000 in 2021, followed by a resurgence to 0.14 per 100,000 in 2022 [35].

Australia

The incidence of IMD among older adults (aged ≥65 years) showed a mixed pattern during the pre-pandemic period (2015-19), with an initial increase until 2017, followed by a decline toward the end of the period. A marked decline in the incidence was observed during the pandemic years (2019-21), followed by a slight rebound in 2023 without exceeding the pre-pandemic levels (Figure 1a). In 2023, a total of 140 IMD cases were confirmed in Australia, marking a 14% increase from the number reported in 2022, but less than the pre-pandemic level, with 202 cases confirmed in 2019 (Figure 1b). The proportion of cases among older adults rebounded to 15% in 2023, failing to reach the pre-pandemic level of 19% observed in 2019 [36–38] (Supplementary Table S3 and Figure 1c).

Incidence of IMD by serogroup in older adults

In the EU/EEA region, serogroup W was most frequently reported among older adults aged ≥65 years in 2016 through 2018, ranging from 30% to 33%, followed by serogroups Y and B [8,16,18,19]. However, in 2022, serogroup Y emerged as the most frequently reported serogroup in this age group, accounting for 46% of cases. This change could not be confirmed for 2023 due to lack of age- and serogroup-specific data for this region (Supplementary Table S4).

According to a study conducted in France, the number of serogroup C cases among adults aged ≥65 years began to decline in 2017, while incidences of serogroups W and Y increased during the same period. Subsequently, serogroup Y emerged as the most prevalent among patients aged ≥65 years, representing an average of 39% of all IMD cases from the end of 2015 to the end of 2021 [13].

In Germany, data from the online portal of the Robert Koch Institute indicate a sharp increase in serogroup Y cases among adults aged ≥65 years, beginning before the pandemic [24]. The proportion of serogroup Y cases was 26% in 2018, rose to 38% in 2019, and exceeded 60% in 2023 (Supplementary Table S4). Serogroup B, the second most frequent, declined steadily from 48% in 2015 to 18% in 2023. This trend was similar to that observed with serogroups C and W, except for a notable increase in the proportion of serogroup W cases observed only in 2021 that reached 28% [24].

Before the pandemic in Italy, IMD cases among adults aged ≥65 years were mostly caused by serogroups B and C (27% each), followed by serogroup Y (21%) [25,26]. In 2022, an increase (30%) in IMD cases due to serogroup Y was observed that became the second most frequent serogroup after serogroup B (40%) (Supplementary Table S4). Based on the report from 2023, serogroup B remained the most common (40%), followed by serogroups W and C (20% each), though these figures were based on a small sample size ($N = 10$) and should be interpreted cautiously [25,26].

The post-pandemic US surveillance reports identified a very sharp increase in serogroup Y cases among older adults (aged ≥65 years), with the incidence nearly three times that of the pre-pandemic period, accounting for approximately 70% of all cases in this age group in 2023 (Supplementary Table S4). Following a peak proportion in 2019 (20%), serogroup W cases declined markedly to below 2% in 2023 [29–34]. Throughout all three periods, the proportions of serogroups B and C decreased. However, serogroup C consistently remained the second most frequent serogroup in this age group after the pandemic [29–34].

In Canada, the surveillance data from 2012 to 2022 identified serogroup B as the most prevalent across all age groups, with an incidence rate of 0.14 per 100,000. Among older adults (aged ≥60 years), serogroups B, Y, and W showed comparable prevalence, with the incidence rates ranging from 0.08 to 0.09 per 100,000. The data provided did not contain year-specific incidence rates categorized by age group and serogroup [35].

In Australia, serogroup W was the most common cause of IMD among adults aged ≥65 years until 2019 (48%) (Supplementary Table S4). During the pandemic, the number of cases from serogroup Y sharply increased in this age group, comprising 70% in 2021 and 60% in 2022. After the pandemic, serogroup B rose to 52% (11/21) of cases in 2023, while serogroups Y and W became the second (28%) and third (14%) most frequent, respectively, among older adults [36,37].

IMD CFR in older adults

Of 14 articles and surveillance reports, one article and four surveillance reports summarized the mortality of IMD in terms of the CFR among older adults covering Europe ($n = 4$) and the United States ($n = 2$). The CFR for three periods (pre-pandemic, during pandemic, and post-pandemic) is presented in Supplementary Table S5 [7,13,16–19,29–34].

The European centre for disease prevention and control (ECDC) reports that the CFR has consistently been higher among adults aged ≥65 years than in that in other age groups throughout the pre-pandemic, pandemic, and post-pandemic periods, with the CFR remaining stable at approximately 18-19% between 2018 and 2022 [8,16,18,19].

Similarly, data from France indicated elevated CFRs associated with IMD in older adults, with discernible age-specific variations across the pre- and post-pandemic periods [13]. Notably, the CFR data corresponding to the period of stringent COVID-19 public health measures were unavailable, limiting direct comparisons during that interval. In the post-pandemic period, individuals aged ≥60 years demonstrated a lower CFR (14% in 2022, compared with 18% in 2018) (Supplementary Table S5).

In England, among older adults aged ≥65 years, the CFRs remained consistently elevated across all time points, with a pronounced increase during the COVID-19 pandemic. Subsequently in 2021-22, CFRs in this age group returned to levels comparable to those observed in the pre-pandemic period [7]. Similarly, in the Netherlands, between 2018 and 2022, CFRs for IMD demonstrated distinct age-specific patterns. Among individuals aged ≥50 years, CFRs remained relatively stable from 2018 to 2020 (ranging from 4% to 6%), dropped to 0% in 2021, and then sharply increased to 18% in 2022 (Supplementary Table S5).

In the United States, fluctuations in the CFRs were reported in the older adults (aged ≥65 years) post-COVID-19 (2% and 16% in 2022 and 2023, respectively) compared with the pre-COVID-19 period (23% and 11% in 2018 and 2019, respectively) (Supplementary Table S5) [29–34].

Discussion

This TLR highlights a clear shift in the epidemiology of IMD among older adults following the COVID-19 pandemic, with an increasing burden among older adults across Europe, North America, and Australia. Several countries reported a resurgence in the number of IMD cases in this age group after the easing of COVID-19 restrictions, in some cases exceeding the pre-pandemic levels. France experienced the most pronounced rise, whereas other countries such as the United States, Spain, and Australia also showed substantial rebounds, though not all returned to previous incidences. Italy and Canada reported more moderate increases, with the incidence remaining below the pre-pandemic levels.

Multiple factors likely contributed to the COVID-19 pandemic decrease in the number of IMD cases and the post-pandemic rebound. Public health interventions during the COVID-19 pandemic, such as lockdowns, reduced social interactions, improved hygiene practices, decreased travel, and avoidance of mass gatherings, significantly reduced exposure to *N. meningitidis* and other respiratory pathogens [6]. Disruptions to routine immunization programs in 2020, driven by temporary service suspensions and limitations in vaccine supply or delivery systems, further reduced the exposure [39]. This prolonged reduction in exposure to circulating pathogens may have led to an “immunity debt” or “immunity gap,” whereby insufficient immune stimulation increased vulnerability to infection once restrictions were lifted—particularly among children and older adults [6,10].

The use of polysaccharide–protein conjugated monovalent MenC and quadrivalent MenACWY vaccines, and more recent protein-based MenB vaccines, has substantially reduced the incidence and burden of IMD in children and adolescents [11,40]. These successful vaccination programs in younger age groups may have contributed to a relative shift in the burden of IMD toward older adults who continue to experience considerable morbidity and mortality. However, in France, the increase was observed in both relative proportions and absolute numbers of IMD cases among older adults suggesting that the pre-pandemic absence of vaccination strategies among adolescents may potentiate the shift to older adults through transmission from adolescents who experienced the early rebound in late 2022 [41].

Cross-country comparisons support this interpretation. Nations without an established adolescent national immunization program (NIP) reported higher proportions of incident cases in older adults—France and Germany reported 24-27%, compared with 12-19% in England, the United States, Italy, or Australia, where adolescents’ MCV4 programs were introduced earlier (in 2015, 2005, 2017, and 2018, respectively) [38,42]. Spain, which only implemented the adolescent NIP in 2019, similarly reported that older adults accounted for 24% of cases in 2023. Variations in vaccine uptake and coverage may also influence these patterns. Updated epidemiological data by age group are needed to further confirm this hypothesis.

The distribution of serogroups among older adults also warrants attention. Serogroup Y emerged as predominant among older adults in Europe, particularly in Germany, France, and the United States, although this trend started before the pandemic [43]. In other countries, serogroup B remained the most frequent in this age group. The predominance of serogroup Y among older adults in certain regions suggests a need to reassess current vaccination strategies, which often focus on serogroups B and C.

This review did not identify consistent trends in the CFR among older adults across the pre-pandemic, pandemic, and post-pandemic periods. However, the CFRs in this age group remained consistently higher than those in younger adults. This aligns with evidence from other studies showing that the IMD mortality rate in older adults was higher than that in any other age group [4,6]. This elevated risk can be attributed to several factors, largely due to underlying comorbidities, atypical clinical presentations that delay diagnosis, and limited vaccine coverage in this age group.

To our knowledge, this literature review is the first to synthetize the evidence of the epidemiology of IMD prior to and post the COVID-19 pandemic, specifically in the older adult subgroup across multiple high-income regions. The findings indicate both an increase in the number of IMD cases in this age group and the rising prominence of serogroup Y. These trends challenge the long-standing perception that IMD primarily affects children and young adults, and that prevention efforts should focus primarily on these groups. Emerging evidence highlights that older adults contribute substantially to the IMD burden and may benefit from reconsideration of current prevention strategies, including the potential value of targeted vaccination approaches.

This review has several limitations stemming from the definition of the COVID-19 period that varied across the article/surveillance reports included and heterogeneity in the reported incidence estimates. Additionally, the age ranges across article/surveillance reports varied; the majority of these studies included mixed-aged populations. No studies providing data for older adults were available from regions such as Latin America, the Middle East, Africa, or Asia, thereby limiting the geographical representativeness of this research. We also identified challenges such as heterogeneity in surveillance systems and constraints in accurately capturing the true incidence of disease and assessing surveillance effectiveness during the COVID-19 pandemic. A potential bias

may arise from the higher frequency of atypical IMD presentations in older adults, which could lead to the underestimation of the true incidence of IMD in this age group [41,44]. While the magnitude of this effect cannot be precisely quantified, it is plausible that the proportion of IMD cases among the older population is significantly higher than that indicated in this study.

Conclusions

These findings underscore the need for broadening meningococcal vaccination strategies to include high-risk populations, particularly older adults, who continue to experience a disproportionately high burden of disease and mortality. While maintaining routine immunization programs for infants and adolescents remains essential for both direct protection and herd immunity, expanding coverage to older adults could address emerging epidemiological trends. In parallel, strengthening surveillance systems and enhancing diagnostic capacity, especially for older populations, is critical to accurately assess the disease burden and guide public health interventions.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of competing interests

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Saber Yezli reports a relationship with Sanofi that includes: consulting or advisory and speaking and lecture fees. Paolo Bonanni reports a relationship with GSK, Sanofi, MSD, Pfizer, Seqirus, Moderna, Janssen that includes: consulting or advisory and speaking and lecture fees. Ener Cagri Dinleyici reports a relationship with GSK, Pfizer, MSD, and Sanofi that includes: consulting or advisory, funding grants, and speaking and lecture fees. Sean Leng reports a relationship with Sanofi, GSK that includes: consulting or advisory. Sean Leng reports a relationship with Sanofi that includes: consulting or advisory and funding grants. Sean Leng reports a relationship with Longeveron LLC that includes: funding grants. Muhamed-Kheir Taha reports a relationship with GSK, Pfizer, Sanofi for the Institut Pasteur, Paris that includes: funding grants. Varun Kumar, Divyesh Thakker, Florence Coste report a relationship with Sanofi that includes: employment. Muhamed-Kheir Taha has patent #NZ630133A issued to GSK. This study was funded by Sanofi. Scientific writing assistance was provided by Sonali Agrawal, PhD, Sanofi, and editorial assistance was provided by Isabel Gregoire, Sanofi. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding

This study was funded by Sanofi.

Ethical approval

As this work is a targeted literature review based solely on previously published literature and does not involve the collection of new data or research with human participants or animals, the requirement of ethical approval and informed consent is not applicable.

Acknowledgments

Scientific writing assistance was provided by Sonali Agrawal, PhD, Sanofi, and editorial assistance was provided by Isabel Gregoire, Sanofi.

Authors' contributions

VK and DT contributed to the methodology and retrieval of information from articles and writing, review, and editing of the manuscript. FC was responsible for conceptualization, methodology, and retrieval of information from surveillance websites and writing, review, and editing of the manuscript. SY contributed to the methodology and review and editing of the manuscript. All other authors participated in the review and editing of the manuscript.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ijid.2026.108502.

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