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주간 건강과 질병

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Content

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Aims and Scope

주간 건강과 질병(*Public Health Weekly Report*) (약어명: *Public Health Wkly Rep*, PHWR)은 질병관리청의 공식 학술지이다. 주간 건강과 질병은 질병관리청의 조사 · 감시 · 연구 결과에 대한 근거 기반의 과학적 정보를 국민과 국내 · 외 보건의료인 등에게 신속하고 정확하게 제공하는 것을 목적으로 발간된다. 주간 건강과 질병은 감염병과 만성병, 환경기인성 질환, 손상과 중독, 건강증진 등과 관련된 연구 논문, 유행 보고, 조사/감시 보고, 현장 보고, 리뷰와 전망, 정책 보고 등의 원고를 게재한다. 주간 건강과 질병은 전문가 심사를 거쳐 매주 목요일(연 50주) 발행되는 개방형 정보열람(Open Access) 학술지로서 별도의 투고료와 이용료가 부과되지 않는다.

저자는 원고 투고 규정에 따라 원고를 작성하여야 하며, 이 규정에 적시하지 않은 내용은 국제의학학술지편집인협의회(International Committee of Medical Journal Editors, ICMJE)의 Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals (https://www.icmje.org/) 또는 편집위원회의 결정에 따른다.

About the Journal

주간 건강과 질병(eISSN 2586-0860)은 2008년 4월 4일 창간된 질병관리청의 공식 학술지이며 국문/영문으로 매주 목요일에 발행된다. 질병관리청에서 시행되는 조사사업을 통해 생성된 감시 및 연구 자료를 기반으로 근거중심의 건강 및 질병관련 정보를 제공하고자 최선을 다할 것이며, 제공되는 정보는 질병관리청의 특정 의사와는 무관함을 알린다. 본 학술지의 전문은 주간 건강과 질병 홈페이지(https://www.phwr.org/)에서 추가비용 없이 자유롭게 열람할 수 있다. 학술지가 더 이상 출판되지 않을 경우 국립중앙도서관(http://nl.go.kr)에 보관함으로써 학술지 내용에 대한 전자적 자료 보관 및 접근을 제공한다. 주간 건강과 질병은 오픈 액세스(Open Access) 학술지로, 저작물 이용 약관(Creative Commons Attribution Non-Commercial License; http://creativecommons.org/licenses/by-nc/4.0)에 따라 비상업적 목적으로 사용, 재생산, 유포할 수 있으나 상업적 목적으로 사용할 경우 편집위원회의 허가를 받아야 한다.

Submission and Subscription Information

주간 건강과 질병의 모든 논문의 접수는 온라인 투고시스템(https://www.phwr.org/submission)을 통해서 가능하며 논문투고 시 필요한 모든 내용은 원고 투고 규정을 참고한다. 주간 건강과 질병은 주간 단위로 홈페이지를 통해 게시되고 있으며, 정기 구독을 원하시는 분은 이메일(phwrcdc@korea.kr)로 성명, 소속, 이메일 주소를 기재하여 신청할 수 있다.

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국내 소아폐렴환자의 호흡기 검체에서 분리된 폐렴구균의 혈청형 분포 현황, 2018–2022년

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초 록

폐렴구균은 균혈증, 세균성 뇌수막염, 폐렴 등을 유발하며, 소아 사망의 원인이 되는 병원체 중 하나이다. 우리나라는 폐렴구균 국가필수예방접종사업에서 소아를 대상으로 단백접합백신 10-valent pneumococcal conjugate vaccine (PCV10)과 13-valent PCV (PCV13)를 접종하고 있다. PCV 도입으로 백신효과를 확인하기 위해 국내에서 분리되는 폐렴구균 혈청형을 분석하는 것은 매우 중요하다. 본 연구는 2018년부터 2022년까지 세균성급성호흡기감염증 병원체감시사업(ARI Net)을 통해 소아폐렴환자의 호흡기 검체에서 분리된 폐렴구균 116주를 확보하였고, PCV13 혈청형과 non-PCV13 혈청형으로 구분하여 혈청형 분포를 분석하였다. 총 15종의 혈청형과 그 외 non-typeable 폐렴구균(non-typeable *Streptococcus pneumoniae*, NTSp)이 확인되었고 PCV13 혈청형 2종이 9.5%, non-PCV13 혈청형 13종이 87.9%, NTSp가 2.6%였다. 주요 혈청형으로는 6C, 23A, 15B, 15C/23B, 10A, 34/35B, 19A/13, 19F순으로 구성되었으며, 전체 분리주의 92.2%를 차지하였다. 5세 미만 연령대에서 15종의 혈청형이 분포하였고, non-PCV13 혈청형이 91%였으며, 상위 혈청형은 6C, 15B, 23A, 15C, 23B순으로 확인되었다. 5세 이상 연령대에서는 non-PCV13 혈청형의 6C와 23A가 가장 많은 분포를 차지하였다. 본 연구 결과를 통해 PCV13 백신에 포함된 혈청형보다 백신에 포함되지 않은 혈청형의 비율이 상대적으로 높은 것으로 확인되었다. 폐렴구균 감염증 관리와 백신 효과를 확인하기 위해 지속적인 ARI Net 운영과 폐렴구균 혈청형의 변화 분석이 필요하다.

주요 검색어: 폐렴구균; 혈청형; 13-valent pneumococcal conjugate vaccine; 소아; 폐렴

서 론

폐렴구균(*Streptococcus pneumonia*, Sp)은 그람양성쌍구균으로 피막(capsule)을 구성하는 피막 다당류(capsular polysaccharide)의 혈청학적 반응에 따라 현재까지 100여종의 혈청형이 알려져 있다[1]. 피막 다당류는 폐렴구균의 주요 병원성인자 중 하나로 혈청형에 따라 다양한 병원성을 나타낸다. 폐렴구균은 균혈증(bacteremia), 세균성 뇌수막염(meningitis), 골수염(osteomyelitis) 등의 침습성 감염증과 폐렴(pneumoniae), 중이염(otismedia), 부비강염(sinusitis) 등의 비침습

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핵심요약

① 이전에 알려진 내용은?

폐렴구균 백신 도입으로 폐렴구균 질환의 발생률은 감소되었고, 우리나라에서는 어린이 국가필수예방접종에 단백접합백신 PCV10과 PCV13을 포함하여 접종하고 있다.

② 새로이 알게 된 내용은?

2018년부터 2022년동안 세균성급성호흡기감염증 병원체감시사업(ARI Net)을 통해 소아폐렴환자의 호흡기 검체에서 분리된 폐렴구균 중 9.5%가 PCV13 혈청형이었고, 87.9%가 non-PCV13 혈청형, 그 외 2.6%가 non-typeable 폐렴구균이었다. 5세 미만 연령대에서 15종의 혈청형이 분포하였고, 상위 혈청형이 6C, 15B, 23A, 15C, 23B 순으로 확인되었다. 5세 이상 연령대에서는 non-PCV13 혈청형의 6C와 23A가 가장 많은 분포를 차지하였다. 본 연구 결과를 통해 PCV13 백신에 포함된 혈청형보다 백신에 포함되지 않은 혈청형의 비율이 상대적으로 높은 것으로 확인되었다.

③ 시사점은?

폐렴구균 감염증 관리와 백신 효과를 확인하기 위해 지속적인 ARI Net 운영과 폐렴구균 혈청형의 분리현황에 대한 지속적인 모니터링이 필요하다.

성 감염증을 유발하며, 전 세계 지역사회 폐렴의 1/3을 차지하고 있는 가장 흔한 세균 중 하나로 전 세계 소아 사망의 원인이 되는 중요한 병원체로 알려져 있다[2]. 2019년 세계보건기구(World Health Organization)에서는 전 세계 740,180명의 어린이가 폐렴구균 감염에 의한 폐렴으로 사망했고 이 중 5세 미만 소아가 전체 사망환자의 14%를 차지하는 것으로 보고하였다[3]. 폐렴구균 감염증은 대부분 백신으로 예방이 가능하며 2000년 이후부터 전 세계에서 7가, 10가, 13가 폐렴구균 결합 백신(pneumococcal conjugate vaccine, PCV)으로 소아 예방접종 프로그램을 운영하고 있다[4]. 이 중 13-valent PCV (PCV13) 백신은 3, 6A, 19A 혈청형에 7-valent PCV (PCV7) (4, 6B, 9V, 14, 18C, 19F, 23F) 백신을 구성하는 혈청형과 10-valent PCV (PCV10) (PCV7 혈청형 7종, 1, 5, 7F) 백신을 구성하는 혈청형을 모두 포함하고 있다[5]. 미국에서는 폐렴구균 백신 효과를 증대하기 위해 PCV13에 폐렴구균 질환을 유발하는 혈청형을 포함한 15-valent PCV (PCV15) (PCV13 혈청형, 22F, 33F)와 20-valent PCV (PCV15 혈청형, 8, 10A, 11A, 12F, 15B)의 접종을 2022년부터 권장하고 있다[6]. 인구기반 감시체계로 PCV 접종 전후 폐렴구균 감염증의 발생률을 조사하여 백신 효과를 분석한 결과에 따르면, 백신을 접종한 소아가 백신 접종을 하지 않은 소아보다 침습성 및 비침습성 폐렴구균 감염증이 모두 감소하는 경향을 보였다[7,8]. 특히, PCV7이 허가된 이후 전 세계적으로 백신형 폐렴구균에 의한 감염증은 크게 감소하였으나, 동시에 백신에 포함되지 않은 비백신(non-PCV)형 폐렴구균의 감염증은 상대적으로 증가하였다[9,10].

우리나라는 2003년 11월부터 PCV7을 도입하고 이 백신을 선택 접종 및 선별 접종의 형태로 분류하여 5세 미만의 어린이에게 접종이 권장되었다. 이후 2010년 3월부터 PCV10과 PCV13이 국내 도입되어 민간 의료기관을 중심으로 접종이 확대되다가 2014년 3월 PCV를 국가필수예방접종 항목으로 포함시켰다. 국내도 다른 국가와 마찬가지로 PCV가 도입된 후 폐렴구균 감염증의 혈청학적 역학관계에 직접 또는 간접적인 영향을 주었고[11] 국내 임상 검체에서 분리된 폐렴구균 혈청형의 유병률도 PCV에 포함된 혈청형에서 비백신 혈청형으로 변경되는 혈청형 대치현상(serotype replacement phenomenon)이 뚜렷해졌다[12].

PCV 도입 직후 유행하는 폐렴구균 혈청형의 변화에 대한 연구는 많은 국가에서 발표되고 있지만 국내에서 PCV 효과에 대한 정보는 매우 제한적이다. 현재 국내 접종되는 PCV 효과를 예측하기 위해서는 PCV 접종이 시행된 이후부터 임상에서 분리된 폐렴구균 혈청형의 유병률 변화를 지속적으로 분석하는 것이 매우 중요하다.

2009년부터 질병관리청은 전국 권역별 2·3차 병원이 참여하는 세균성급성호흡기감염증 병원체감시사업(ARI Net) 운

영을 통해 호흡기질환 원인세균을 수집하고 혈청형, 항생제 내성 등 병원체 특성을 분석하여 시기별 유행현황을 확인하는데 활용하고 있다[13]. 본 연구는 PCV 접종 효과를 확인하기 위해 ARI Net을 통해 확보된 소아폐렴환자 분리 폐렴구균의 혈청형 분포와 역학적 특성을 분석하여 국내 폐렴구균 혈청형 변화 정보를 제공하고자 한다.

방 법

폐렴구균 혈청형은 2018년 8월부터 2022년 6월까지 급성호흡기세균 병원체감시에 참여하는 의료기관에 폐렴으로 내원한 18세 미만 소아환자 중 항생제 치료 전 비인두흡인물, 객담 등 호흡기검체에서 분리된 폐렴구균 116주를 대상으로 분석하였다. 소아폐렴환자는 기침, 가래 등 호흡증상이 확인되고 흉부 방사선 검사에서 폐침윤을 보이는 환자로 정의하였고 환자의 검체정보는 환자보호자로부터 받은 활용동의서를 기반으로 충남대학교병원 의학연구윤리심의위원회의 승인을 받아 활용하였다(IRB 승인번호: 2019-07-037-019). 분리된 균은 용혈성과 집락 형태, 그람 염색, 카탈라아제(catalase) 검사, 옵토친(optochin) 디스크 감수성 및 담즙 용해 검사와 라텍스(latex) 응집반응 검사 등 생화학 검사를 통해 폐렴구균으로 최종 확인하였다. 혈청형 결정은 폐렴구균 특이 항혈청을 사용한 협막팽화 시험법(quellung reaction)과 미국 질병통제센터(Centers for Disease Control and Prevention)에서 제공한 폐렴구균 혈청형 분석 polymerase chain reaction (PCR) 시험을 수행하여 혈청형을 분류하였다. 시험 결과는 PCV13에 포함되는 혈청형을 기준으로 포함되지 않은 혈청형을 non-PCV13 혈청형으로 정의한 후 분리된 폐렴구균의 혈청형을 분석하였다.

결 과

본 감시에서 폐렴구균이 분리된 검체는 비인두흡입물 102건, 객담 5건, 비인두도말물 3건, 기관지 세척액 1건, 기타(미상) 검체 5건이었고 비인두흡입물이 전체 87.9%를 차지하였다. 환자들의 연령은 0-4세 100명, 5-9세 13명, 10-14세 1명, 연령 미상이 2명이었고 성비는 정보가 확인되지 않은 2명을 제외하고 남아 57명, 여아 57명으로 동일하게 확인되었다. 환자들의 임상증상은 기침이 41명으로 가장 많았고 발열이 33명, 기침·발열이 19명, 기침·가래/기침·비루/기침·발열·가래 각 2명, 기타(무호흡, 천명, 호흡 장애 등)가 17명으로 확인되었다(표 1).

폐렴구균 116주에 대한 혈청형 분석을 실시한 결과, 13, 34, 10A, 11A, 15A, 15B, 15C, 19A, 19F, 22F, 23A, 23B, 35B, 6C, 9N 총 15종의 혈청형이 확인되었고 그 외는 non-typeable 폐렴구균(NTSp)이었다. 우세 혈청형으로

표 1. 폐렴구균이 분리된 소아폐렴환자의 검체 종류 및 임상 증상 분포

구분	연령				총합
	5세 미만	5-9세	10-14세	연령 미상	
전체	100	13	1	2	116
검체					
비인두흡인물	91	10	1		102
객담	4	1			5
비인두도말물	2	1			3
기관지세척액		1			1
기타	3			2	5
임상증상					
기침	37	3	1	0	41
발열	28	5	0	0	33
기침, 발열	16	3	0	0	19
기침, 가래	2				2
기침, 비루	2				2
기침, 발열, 가래	1	1			2
기타[a)]	14	1		2	17

단위: 명. [a)]무호흡, 천명, 호흡 장애 등.

는 6C, 23A, 15B, 15C/23B, 10A, 34/35B, 19A/13, 19F 순으로 확인되었으며, 이 혈청형들은 전체 분리주의 92.2% (107주)를 차지했다. 특히, 혈청군 15 (15A, 15B, 15C), 23 (23A, 23B)이 전체 43.9% (51주)를 차지하여 우세 혈청군으로 확인되었다. 백신과의 연관성을 기준으로 분류했을 때, PCV13 혈청형 2종(19A, 19F) 9.5% (11주), non-PCV13 혈청형 13종(10A, 13, 11A, 15A, 15B, 15C, 22F, 23A, 23B, 34, 35B, 6C, 9N) 87.9% (102주), NTSp 2.6% (3주)로 확인되었다(표 2).

총 116주의 폐렴구균은 2018년 18주, 2019년 66주, 2020년 10주, 2021년 10주, 2022년 12주로 수집되었으며, 연도별 폐렴구균의 혈청형 분포는 2018년 15B/34-19F-23A/6C-10A/15A, 2019년 23A-6C-23B/35B-10A-15C, 2020년 15B/15C/10A/34-23A/35B, 2021년 15C-23A/6C-13/19A/23B, 2022년 15B/6C-23B-13/19A순으로 분석되었다(그림 1). PCV13 혈청군 19는 2020년도를 제외하고 2018년 16.7% (3주), 2019년 9.1% (6주), 2021년 10.0% (1주), 2022년 8.3% (1주)로 확인되었으며, 지난 4년 동안 감소 추세인 것으로 나타났다. 혈청형 19F는 2018년 16.7% (3주), 2019년 3.0% (2주)로 확인된 것을 제외하고 모두 19A 혈청형으로 확인되었다. Non-PCV13 혈청형의 경우 2019년도에 13종(15A, 15B, 15C, 23A, 23B, 6C, 10A, 34, 35B, 13, 9N, 11A, 22F)의 다양한 혈청형이 분포하였고, 그 중 혈청군 23이 25.8% (17주)로 높은 비율을 차지하였다. 혈청군 15는 2019년을 제외하고 2018년 27.8% (5주), 2020년 40.0% (4주), 2021년 30.0% (3주), 2022년 33.3% (4주)로 다른 혈청군에 비해 우세하였다. 2018–2022년 동안 확인된 폐렴구균의 연도별 혈청형 종류의 분포는 비교적 유사한 수준으로 분석되었으나 3종(11A, 22F, 9N)의 혈청형은 2019년도에만 확인되었다.

표 2. PCV13과 non-PCV13의 폐렴구균 혈청형 분포

혈청형	건수(%)
PCV13[a)]	11 (9.5)
19F	5 (4.3)
19A	6 (5.2)
Non-PCV13	102 (87.9)
6C	17 (14.6)
23A	15 (12.9)
15B	13 (11.2)
15C	10 (8.6)
23B	10 (8.6)
10A	9 (7.7)
34	8 (6.9)
35B	8 (6.9)
13	6 (5.2)
15A	3 (2.6)
11A	1 (0.9)
22F	1 (0.9)
9N	1 (0.9)
Non-typeable 폐렴구균	3 (2.6)

PCV13=13-valent pneumococcal conjugate vaccine. [a)]1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, 23F.

소아환자의 연령별 혈청형 분포를 보면 전 연령에서 분리된 폐렴구균의 PCV13과 non-PCV13 혈청형의 분포 비율은 각각 약 10.0%와 90.0%였으며 6C와 23A의 non-PCV 혈청형이 가장 많은 분포를 보였다. 0–4세 연령대에서 상위 5종에 대한 혈청형은 6C-15B-23A-15C-23B순이었고 5세 이상의 연령대에서는 6C/23A-13/19F-10A/23B/34순으로 확인되었다. 0–4세 연령대에서 확인된 non-PCV13 혈청형 15B, 19A, 11A, 22F는 이 연령대를 제외한 모든 연령대에서 확인되지 않았다. 한편 PCV13 혈청군 19는 전 연령대에서 확인되었고 0–4세 연령대에서는 19A가 19F에 비해 2배 우세했으나 4세 이상 연령대에서는 모두 19F만 확인되었다(그림 2).

논 의

본 연구결과에서 지난 4년간 국내 발생 소아폐렴환자 분리 폐렴구균에서 PCV13 혈청형이 9.5% (11주),

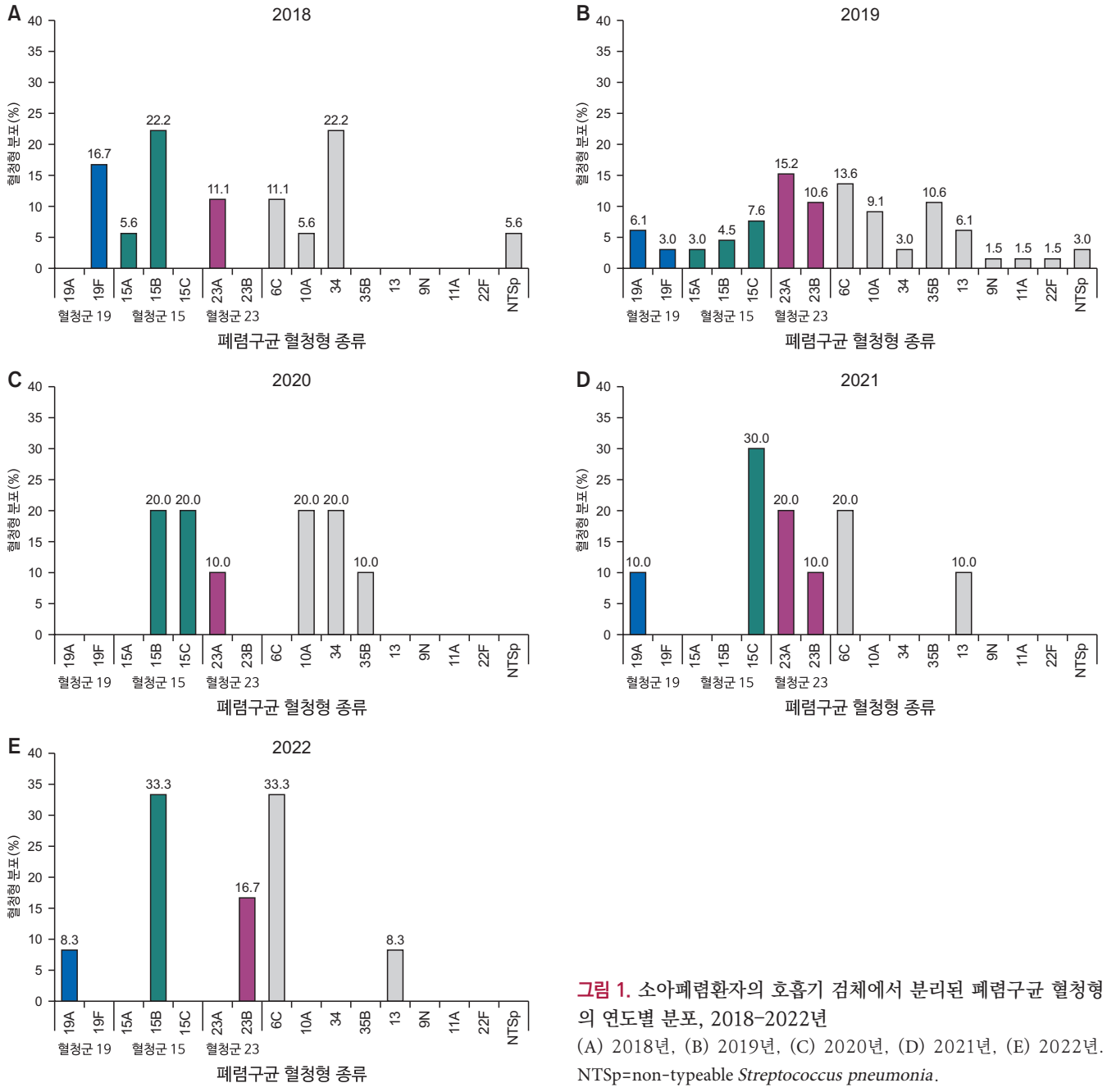

그림 1. 소아폐렴환자의 호흡기 검체에서 분리된 폐렴구균 혈청형의 연도별 분포, 2018–2022년

(A) 2018년, (B) 2019년, (C) 2020년, (D) 2021년, (E) 2022년. NTSp=non-typeable *Streptococcus pneumonia*.

non-PCV13 혈청형이 87.9% (102주)로 PCV13 혈청형보다 non-PCV13 혈청형의 비율이 상대적으로 높게 나타났다. 또한, 전 세계적으로 PCV13이 도입된 이후 침습성 폐렴구균 혈청형 분포는 국가별로 non-PCV13 혈청형을 중심으로 다양한 분포를 보이고 있다. 미국의 경우 PCV 도입 전 대비 PCV13 도입 후 혈청형 15B/C와 33F의 분포율은 0.7%에서 12.6%로 18배 증가하였고, 영국과 일본에서는 혈청형 15A, 23A, 22F의 분포율이 5% 이상 증가한 것으로 보고되었다[14-16]. 그리고 PCV13 혈청형 19A는 미국, 영국, 스웨덴 등 여러 국가에서 지속적으로 확인되는 것으로 보고되었다[17]. 우리나라도 백신 접종 이후인 2014년부터 2019년 동안 침습성 폐렴구균 감염환자에서 분리된 혈청형 역학 분석 보고에 따르면 5세 미만 연령에서 PCV13 혈청형은 2.6%로 가장 흔한 혈청형은 19A였으며, non-PCV13 혈청형은 11.1%로

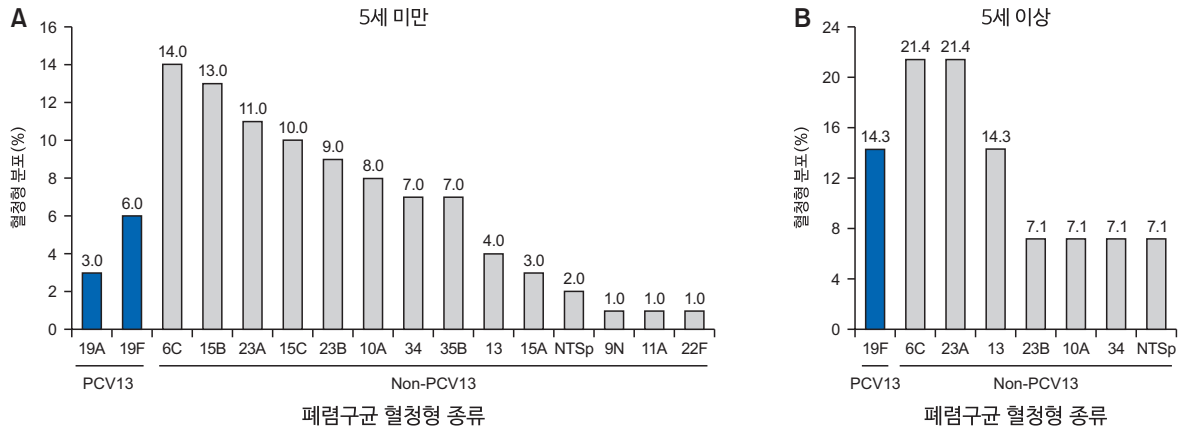

그림 2. 연령별 소아폐렴환자의 호흡기 검체에서 분리된 폐렴구균의 혈청형 분포
(A) 5세 미만 연령, (B) 5세 이상 연령. NTSp=non-typeable *Streptococcus pneumonia*; PCV13=13-valent pneumococcal conjugate vaccine.

혈청형 10A, 23A, 15B/C가 대부분 관찰되었다[18]. 본 연구에서도 5세 미만 연령에서 non-PCV13 혈청형 중 혈청군 15 (15A, 15B, 15C)는 26%, 혈청군 23 (23A, 23B)은 20%, 혈청형 6C은 14%, 혈청형 10A는 8% 이었으며, PCV13 혈청형 19A는 5세 미만 연령에서만 확인되었다. 이처럼 우리나라에 PCV 백신이 도입되고 2014년 3월부터 국가필수예방접종 항목으로 포함된 이후 국내에서도 다른 국가에서의 보고와 마찬가지로 백신에 포함된 혈청형의 비율은 감소하고 상대적으로 비 백신 혈청형이 증가하는 혈청형 대치현상이 일어난 것으로 확인되었다[12,18,19]. 현재 국내에서는 2014년부터 소아를 대상으로 PCV10 또는 PCV13 접종을 시행하고 있으며, 미국에서는 PCV13 또는 PCV15 접종을 권장하여 폐렴구균 감염을 예방하고 있다. 많은 국가들에서 폐렴구균 백신을 예방접종프로그램에 포함하면서 소아에서 폐렴구균 감염증 예방에 효과적이고 미접종 사람에게도 군집면역에 의한 간접효과로 폐렴구균 감염증의 감소가 보고되었다[5].

본 연구 결과는 코로나바이러스감염증-19 팬데믹 이후로 소아폐렴환자의 검체 수집 건수가 현저히 감소하여 2020년 이후에는 소수의 혈청형 데이터로 분석되었으며, 폐렴구균 백신 접종 여부 등의 역학 자료가 고려되지 않은 분석으로 제한적이다. 그러나 국내 소아폐렴환자의 폐렴구균 혈청형 분포를 확인한 기초자료로 활용될 수 있을 것이다. 향후 폐렴구균 백신의 효과 검증과 폐렴구균 유행 혈청형 및 혈청형 대치현상의 파악 등 폐렴구균 감염증 관리와 폐렴구균 혈청형과 백신과의 연관성 분석을 위한 지속적인 감시가 필요하다.

Declarations

Ethics Statement: This study was approved by the Institutional Review Board and Ethics Committee of Chungnam National University Hospital (IRB No. 2019-07-037-019). The parents of all study participants gave written informed consent before study enrollment. All methods were performed in accordance with the relevant guidelines and regulations.

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Conflict of Interest: The authors have no conflicts of interest to declare.

Author Contributions: Conceptualization: JY, JK, JHJ, JL. Data curation: JL, YBK. Formal analysis: JL, JK. Investigation: JL, YBK. Methodology: JL, YBK. Supervision: JY, JK. Visualization: JL. Writing – original draft: JL. Writing – review & editing: JY, JK, JHJ.

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Serotype Distribution of *Streptococcus pneumoniae* from Respiratory Specimen of Children with Pneumonia in the Republic of Korea, 2018–2022

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ABSTRACT

Streptococcus pneumoniae is the major pathogen causing pneumonia, bacteraemia and meningitis, and one of the leading causes of death in children. In the Republic of Korea (ROK), the national pneumococcal vaccination program for children was inoculated with protein conjugated vaccines 10-valent pneumococcal conjugate vaccine (PCV10) and 13-valent PCV (PCV13). It is very important to analyze the *S. pneumoniae* serotypes isolated in the ROK to confirm the vaccine efficacy by PCV introduction. In this study, 116 *S. pneumoniae* were isolated from respiratory specimen of children with pneumonia through an acute respiratory infections network (ARI-NET) from 2018 to 2022. The isolated strains were divided into PCV13 and non-PCV13, and serotypes were analyzed. A total of 15 serotypes and other non-typeable *S. pneumoniae* (NTSp) were confirmed. The distributions of PCV13, non-PCV13 and NTSp serotypes were 9.5%, 87.9% and 2.6%, respectively. The main serotypes consisted of 6C, 23A, 15B, 15C/23B, 10A, 34/35B, 19A, 19F, and 15A, in that order, accounting for 92.2% of all isolates. There were 15 serotypes distributed at ages <5 years, with 91% non-PCV13 serotypes, and the major serotypes were identified in the order 6C, 15B, 23A, 15C, and 23B. Non-PCV13 serotypes 6C and 23A accounted for the highest distribution in the age ages >5 years. This study showed the ratio of serotypes not included in the vaccine was relatively higher than that of the serotypes included in the PCV13. In order to manage pneumococcal infection and confirm the vaccine efficacy, it is necessary to continuously operate an ARI-NET and analysis of changes in *S. pneumoniae* serotype.

Key words: *Streptococcus pneumoniae*; Serotype; 13-valent pneumococcal conjugate vaccine; Children; Pneumonia

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Introduction

The gram-positive bacterium *Streptococcus pneumoniae* comprises approximately 100 known serotypes, as determined by serological responses to the capsular polysaccharides of these bacteria [1], and as the main virulence factors, these polysaccharides contribute to differences in the pathogenicity of the different *S. pneumoniae* serotypes. *S. pneumoniae* causes invasive diseases, including bacteremia, bacterial meningitis, and osteomyelitis, and non-invasive diseases such as pneumoniae,

Key messages

① What is known previously?

Pneumococcal vaccines lead to decrease the incidence of pneumococcal disease In the Republic of Korea, the national immunization program for children includes the protein conjugate vaccines PCV10 and PCV13.

② What new information is presented?

Of the *S. pneumoniae* isolated from respiratory specimen of children with pneumonia through ARI-NET from 2018 to 2022, 9.5% were PCV13 serotypes and 87.9% were non-PCV13 serotypes, and 2.6% were non-typeable *Streptococcus pneumoniae*. Total 14 serotypes were distributed at ages <5 years, with 91% non-PCV13 serotypes, and the major serotypes were identified in the order 6C, 15B, 23A, 15C, and 23B. Non-PCV13 serotypes 6C and 23A showed the highest distribution in the age ages >5 years. In the results of this study, it was confirmed that the ratio of serotypes not included in the vaccine was relatively higher than that of the serotypes included in PCV13.

③ What are implications?

In order to manage pneumococcal infection and confirm the vaccine efficacy, it is necessary to continuous monitering of the *S. pneumoniae* serotype distribution through ARI-Net.

otitis media, and sinusitis. It is among the most common bacterial species, accounting for 1/3 of community-acquired pneumonia, and as such, is a key pathogen responsible for the death of many children worldwide [2]. In 2019, the World Health Organization reported that 740,180 children died of pneumonia attributable to pneumococcal infection, 14% of whom were under 5 years of age [3]. In most cases, pneumococcal infections can be prevented by vaccination, and since 2000, 7-, 10- or 13-valent pneumococcal conjugate vaccines (PCVs) have been administered in vaccination programs for children worldwide [4]. Among these vaccines, PCV13 includes serotypes 3, 6A, and 19A, as well as the serotypes of PCV7 (serotypes 4, 6B, 9V, 14, 18C, 19F, and 23F) and PCV10 (the seven serotypes of PCV7 and serotypes 1, 5, and 7F) [5]. In the U.S.A., since 2022, vaccination using PCV15 (the serotypes of PCV13 and serotypes 22F and 33F) and PCV20 (the serotypes of PCV15 and serotypes 8, 10A, 11A, 12F, and 15B), which includes the serotypes causing pneumococcal infections and the serotypes of PCV13, has been recommended to maximize the efficacy of *S. pneumoniae* vaccines [6]. In a study involving a population-based monitoring system, in which the effects of vaccination were analyzed based on estimates of the incidence of pneumococcal infections before and after the use of PCVs, vaccinated children were found to show a trend of reduced incidence of both invasive and noninvasive pneumococcal infections compared with unvaccinated children [7,8]. Notably, since the approval of the PCV7 vaccine, there has been a substantial decline in the global incidence of pneumococcal infections attributable to the serotypes included in this PCV, whereas infections caused by serotypes not included in this PCV (non-PCV) have undergone a simultaneous relative increase [9,10].

In the Republic of Korea (ROK), PCV7 was introduced in November 2003, and the respective vaccination in children below 5 years of age was recommended, although the vaccine was categorized as *optional*. The subsequent introduction of PCV10 and PCV13 in March 2010 extended the scope of vaccination, although mostly among private medical centers until PCVs were included in the National Immunization Program (NIP) in March 2014. As with other countries worldwide, the introduction of PCVs in the ROK had both direct and indirect effects on the serological epidemiology [11], characterized by

a distinct serotype replacement phenomenon, in which the *S. pneumoniae* serotypes isolated from clinical specimens in the ROK underwent a change in the prevalence from PCV to non-PCV serotypes [12].

Although numerous studies conducted worldwide have reported changes in the prevalence of *S. pneumoniae* serotypes immediately after the introduction of PCVs, only a limited set of data on the effects of PCVs are available for the ROK. Accordingly, to predict the effects of the PCVs used in vaccination programs in the ROK, it is essential that changes in the prevalence of clinically isolated *S. pneumoniae* serotypes are continuously monitored immediately after PCV vaccination.

In this regard, since 2009, the Korea Disease Control and Prevention Agency has managed the Acute Respiratory Infection Network (ARI Net), which in conjunction with the participation of regional secondary and tertiary hospitals has the aim of monitoring bacterial pathogens nationwide. Through the ARI Net, the causal pathogens of respiratory diseases are isolated and the associated virulence properties, including the serotype and antibiotic resistance, are analyzed, with the data thus obtained being applied in determining prevalence status at a given point in time [13]. The aim of the present ARI Net-associated study was to provide data on the changes in *S. pneumoniae* serotype prevalence in the ROK, based on an analysis of the serotype distribution and epidemiological characteristics of *S. pneumoniae* isolated from pediatric patients with pneumonia, thereby enabling us to verify the effects of PCV vaccination.

Methods

For our analysis of *S. pneumoniae* serotypes, we isolated 116 strains of *S. pneumoniae* from respiratory specimens, including nasopharyngeal and sputum samples, collected prior to antibiotic treatment. These samples had been collected from pediatric patients (aged <18 years) with pneumonia, who had been admitted to medical centers participating in the ARI Net during the period from August 2018 to June 2022. The inclusion criteria for pediatric patients with pneumonia were those with confirmed respiratory symptoms, such as cough and sputum, and showing infiltration of the lungs on chest radiographs. Prior to the use of patient specimen data, approval was gained from the Institutional Review Board of Chungnam National University Hospital, based on consent obtained from the patients' guardians (IRB No. 2019-07-037-019). The bacterial species isolated from the specimens were confirmed as *S. pneumoniae* using a range diagnostic biochemical tests, including analyses of hemolysis and colony type, Gram-staining, catalase test, optochin disc susceptibility test, bile solubility test, and latex agglutination assay. The serotypes were classified based on the Quellung reaction using anti-serum specific to *S. pneumoniae* and a polymerase chain reaction (PCR) for *S. pneumoniae* serotypes, provided by the U.S.A. Centers for Disease Control and Prevention. The test results were analyzed to identify the *S. pneumoniae* serotypes, which were classified as either PCV13 serotypes (i.e., those serotypes included in the PCV13 vaccine) and non-PCV13 serotypes.

Results

The specimens from which *S. pneumoniae* strains were isolated consisted of 102 nasopharyngeal aspirates, five sputum samples, three nasopharyngeal swabs, one bronchoalveolar lavage, and five others (unknown). Nasopharyngeal aspirates

accounted for the overwhelming majority (87.9%) of samples. In terms of patient age, the numbers of patients in the designated age groups were as follows: 0–4 years, 100; 5–9 years, 13; and 10–14 years, one. In addition there were two patients of unknown age. With respect to gender, having excluded two patients of unknown gender, there were an identical number of males and females (n=57). Among the clinical symptoms of patients, the largest number of patients had a cough (n=41), followed by fever (n=33), cough and fever (n=19), cough and sputum (n=2), cough and rhinorrhea (n=2), cough, fever, and sputum (n=2), and others (e.g., apnea, wheezing, and dyspnea; n=17) (Table 1).

Analysis of the serotypes the of 116 *S. pneumoniae* isolates revealed a total of 15 serotypes, namely, 13, 34, 10A. 11A, 15A, 15B, 15C, 19A, 19F, 22F, 23A, 23B, 35B, 6C, and 9N, in addition to non-typeable *S. pneumoniae* (NTSp). Among these, 6C was identified as the predominant serotype, followed by 23A, 15B, 15C/23B, 10A, 34/35B, 19A/13, and 19F, which collectively accounted for 92.2% (107) of all isolated strains. Notably, the dominant serogroups were 15 (15A, 15B, and 15C) and 23 (23A and 23B), accounting for 43.9% (51) of the strains. With respect to the vaccine, 9.5% (11 strains) corresponded to two of the serotypes comprising the PCV13 vaccine (19A and 19F), whereas 87.9% (102 strains) were 13 non-PCV13 serotypes (10A, 13, 11A, 15A, 15B, 15C, 22F, 23A, 23B, 34, 35B, 6C, and 9N) and 2.6% (3 strains) were NTSp (Table 2).

With respect to the year of isolation, 18 of the 116 *S. pneumoniae* strains were isolated in 2018, 66 in 2019, 10 in 2020, 10 in 2021, and 12 in 2022. The annual *S. pneumoniae* serotype distribution was as follows: 15B/34-19F-23A/6C-10A/15A in 2018; 23A-6C-23B/35B-10A-15C in 2019; 15B/15C/10A/34-23A/35B in 2020; 15C-23A/6C-13/19A/23B in 2021; and 15B/6C-23B-13/19A in 2022 (Figure 1). With the exception of the year 2020, we detected a general decline in the incidence of PCV13 serogroup 19 over

Table 1. Distribution of specimens and clinical symptoms of *S. pneumoniae* from children with pneumonia

Division	Age group (yr)				Total
	<5	5–9	10–14	Unknown	
Total	100	13	1	2	116
Specimens					
Nasopharyngeal aspirate	91	10	1		102
Sputum	4	1			5
Nasopharyngeal swab	2	1			3
Bronchoalveolar lavage		1			1
Unknown	3			2	5
Clinical findings					
Cough	37	3	1	0	41
Fever	28	5	0	0	33
Cough and fever	16	3	0	0	19
Cough and sputum	2				2
Cough and rhinorrhea	2				2
Cough, fever, sputum	1	1			2
Etc[a)]	14	1		2	17

Values are presented as number only. [a)]Apnea, wheezing, dyspnea, and so on.

Table 2. Distribution of *S. pneumoniae* serotypes (PCV13 and non-PCV13)

Serotype	No. of isolates (%)
PCV13[a)]	11 (9.5)
19F	5 (4.3)
19A	6 (5.2)
Non-PCV13	102 (87.9)
6C	17 (14.7)
23A	15 (12.9)
15B	13 (11.2)
15C	10 (8.6)
23B	10 (8.6)
10A	9 (7.8)
34	8 (6.9)
35B	8 (6.9)
13	6 (5.2)
15A	3 (2.6)
11A	1 (0.9)
22F	1 (0.9)
9N	1 (0.9)
Non-typeable *Streptococcus pneumoniae*	3 (2.6)

PCV13=13-valent pneumococcal conjugate vaccine. [a)]1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, 23F.

the past 5 years: 16.7% (3 strains) in 2018, 9.1% (6 strains) in 2019, 10.0% (1 strain) in 2021, and 8.3% (1 strain) in 2022. Apart from the strains with serotype 19F [16.7% (3 strains) in 2018 and 3.0% (2 strains) in 2019], the serotype of all other serogroup 19 strains was identified as 19A. In 2019, we detected the occurrence several non-PCV13 serotypes (15A, 15B, 15C, 23A, 23B, 6C, 10A, 34, 35B, 13, 9N, 11A, and 22F), among which, serogroup 23 accounted for a high proportion (25.8%, 17 strains). However, with the exception of 2019, serogroup 15 was identified as the predominant type, accounting for 27.8% (5 strains) in 2018, 40.0% (4 strains) in 2020, 30.0% (3 strains) in 2021, and 33.3% (4 strains) in 2022. Notably, for the period from 2018 to 2022, we established that the annual distribution of the different *S. pneumoniae* serotypes was relatively constant, although three serotypes (11A, 22F, and 9N) were detected only in 2019.

Analysis of the distribution of serotypes according to the age of the pediatric patients revealed that among all age groups, the PCV13 and non-PCV13 serotypes of *S. pneumoniae* isolates accounted for approximately 10.0% and 90.0%, respectively, with the non-PCV serotypes 6C and 23A showing the largest distribution. The top five serotypes identified from patients aged 0 to 4 years in order of prevalence were 6C-15B-23A-15C-23B, whereas those from patients aged 5 years and older in order of prevalence were 6C/23A-13/19F-10A/23B/34. The non-PCV13 serotypes 15B, 19A, 11A, and 22F, which were identified among patients in the 0 to 4 year age group, were not detected in any of the other age groups. Contrastingly, PCV13 serogroup 19 was detected among all age groups, of which serotype 19A predominated 19F by 2-fold in patients aged between 0 and 4 years, whereas among patients older than 4 years, only the 19F serotype was detected (Figure 2).

Discussion

This study revealed that among the *S. pneumoniae* isolated from pediatric patients with pneumonia in the ROK over the past 4 years, the relative proportion of non-PCV13 serotypes [87.9% (102 strains)] has exceeded that of PCV13 serotypes [9.5% (11 strains)]. Following the introduction of PCV13, the distribution of invasive *S. pneumoniae* serotypes worldwide has also varied, particularly with respect to non-PCV13 serotypes. For example, in the U.S.A., distribution of the 15B/C and 33F serotypes increased 18-fold from 0.7% to 12.6%, and in the U.K. and Japan, the distribution of serotypes 15A, 23A, and 22F increased by ≥5% [14-16]. Moreover, the PCV13

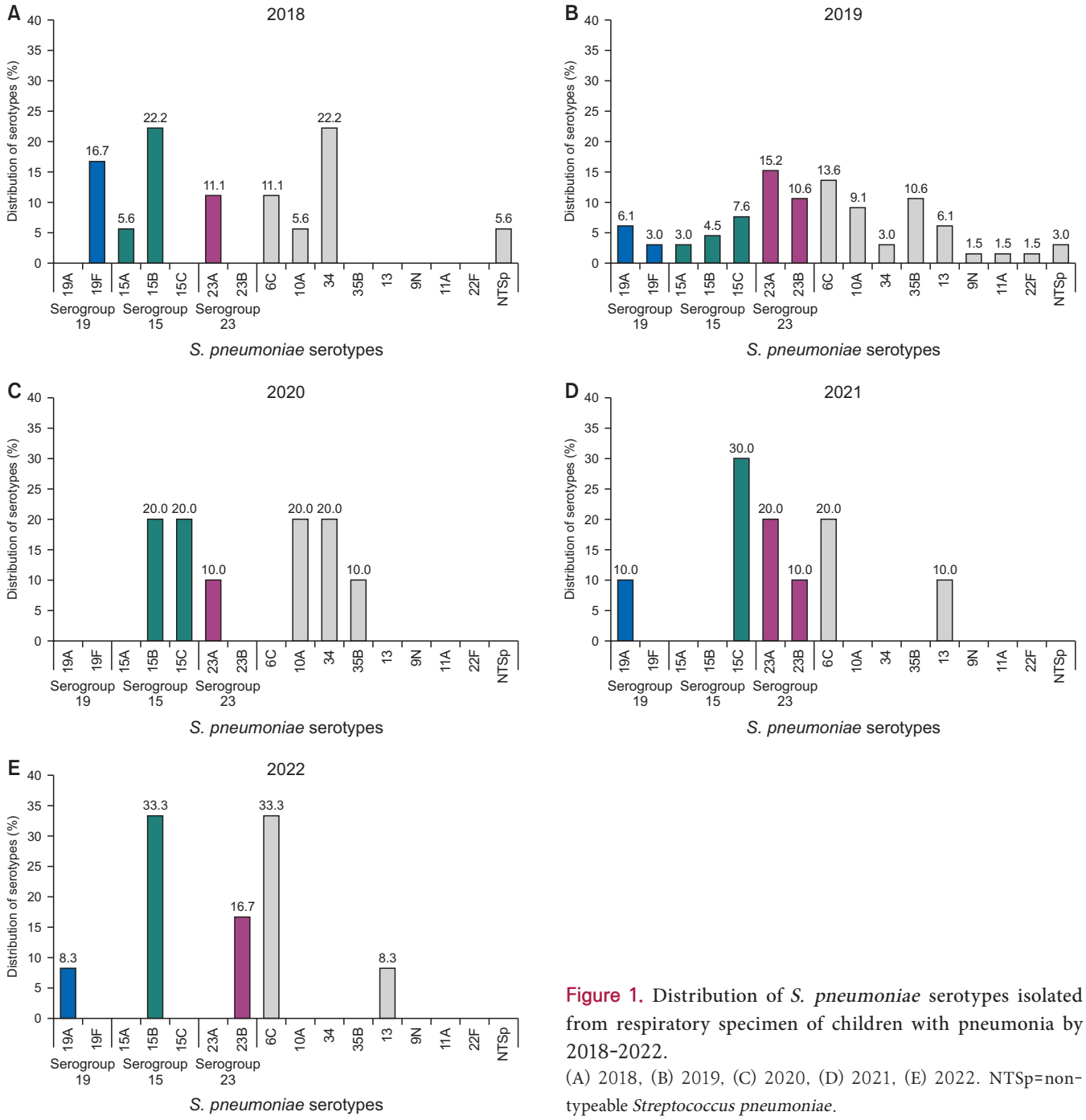

Figure 1. Distribution of *S. pneumoniae* serotypes isolated from respiratory specimen of children with pneumonia by 2018-2022.
(A) 2018, (B) 2019, (C) 2020, (D) 2021, (E) 2022. NTSp=non-typeable *Streptococcus pneumoniae*.

serotype 19A has constantly been detected in several countries, including the U.S.A., the U.K. and Sweden [17]. Consistently, in the ROK, an epidemiological study of the *S. pneumoniae* serotypes isolated from patients with invasive pneumococcal infection following vaccination during the period from 2014 to 2019 reported 19A to be the most common PCV13 serotype (2.6%) in children aged <5 years, whereas the most common non-PCV13 serotypes (11.1%) were 10A, 23A, and 15B/C [18]. Similarly, in the present study, we found that non-PCV13 serotypes consisted of serogroup 15 (15A, 15B, and

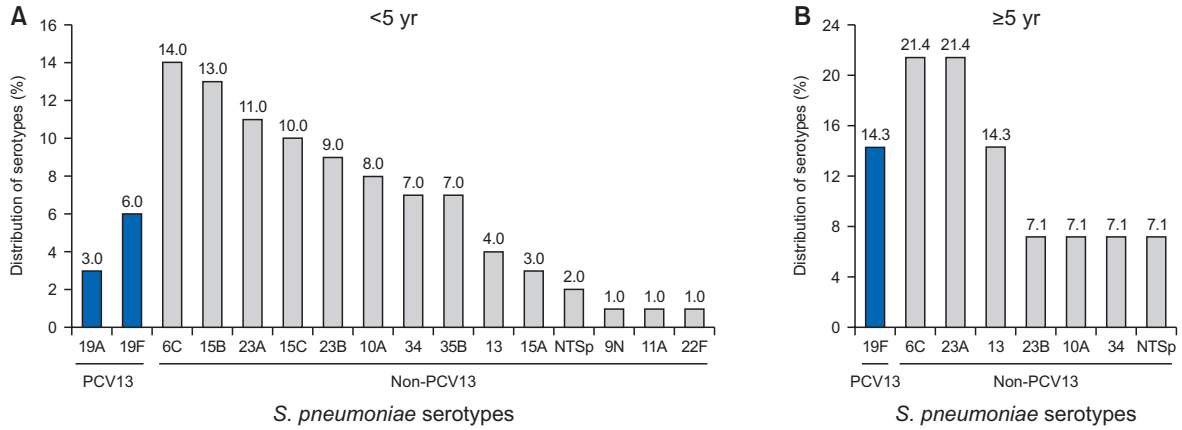

Figure 2. Distribution of *S. pneumoniae* serotypes isolated from respiratory specimen of children with pneumonia by age.
(A) Under 5 years old, (B) 5 years of age or older. PCV13=13-valent pneumococcal conjugate caccine; NTSp=non-typeable *Streptococcus pneumoniae*.

15C; 26%), serogroup 23 (23A and 23B; 20%), serotype 6C (14%), and serotype 10A (8%). And serotypes 19A (PCV13) was only found from children below 5 years of age. These findings thus indicate that since the introduction of PVCs in March 2014 and their subsequent inclusion in the NIP in the ROK, there has been a reduction in the proportion of PCV serotypes, with a concomitant relative increase in the non-PCV serotypes, which is consistent with the changing patterns of serotype prevalence detected in other countries [12,18,19]. Since 2014, children in the ROK have been vaccinated for pneumonia using either the PCV10 or PCV13 vaccines, whereas in the U.S.A., vaccination using PCV13 or PCV15 is recommended for the prevention of pneumococcal infections. In several countries in which vaccination programs include *S. pneumoniae* vaccines, reductions in pneumococcal infections have been reported, which thus tends to verify the efficacy of these vaccines in preventing infections in children and indicates the indirect effects of herd immunity in unvaccinated individuals [5].

A limitation of this study is that, as a consequence of a substantial decline in the number of specimens collected from children with pneumonia since the outbreak of the coronavirus disease 2019 pandemic, it has only been possible to obtain a small serotype dataset since 2020, and we were also unable to take into account epidemiological data such as that for pneumococcal vaccination. Nevertheless, in spite of these shortcomings, the findings of this study will prove useful as basic data revealing the distribution of *S. pneumoniae* serotypes among pediatric patients with pneumonia in the ROK. Further studies should be conducted to identify the prevalent *S. pneumoniae* serotypes and to investigate the changing patterns in serotype prevalence in response to vaccination, thereby enabling verification of the efficacy of *S. pneumoniae* vaccines. In conjunction with continuous monitoring to determine the association between vaccines and *S. pneumoniae* serotypes, the findings of such studies will contribute to the effective management of pneumococcal infections.

Declarations

Ethics Statement: This study was approved by the Institutional Review Board and Ethics Committee of Chungnam National University Hospital (IRB No. 2019-07-037-019).

The parents of all study participants gave written informed consent before study enrollment. All methods were performed in accordance with the relevant guidelines and regulations.

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Conflict of Interest: The authors have no conflicts of interest to declare.

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2023년 세계 콩팥의 날

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초 록

매년 3월 두 번째 목요일에 「세계 콩팥의 날」을 기념하고 있으며, 올해 3월 9일은 18번째로 맞는 세계 콩팥의 날이다. 국제신장학회와 국제신장재단연맹에서는 올해 캠페인 주제로 '예상치 못한 상황 대응 계획 마련으로 취약계층 지원!(Preparing for the unexpected, supporting the vulnerable!)'을 선정하였으며, 콩팥 관리의 중요성에 대한 인식 제고를 위해 노력하고 있다.

주요 검색어: 세계 콩팥의 날, 콩팥, 만성콩팥병, 인식

세계 콩팥의 날은 국제신장학회(International Society of Nephrology, ISN)와 국제신장재단연맹(International Federation Kidney Foundations, IFKF)에서 콩팥 관리의 중요성에 대한 인식을 제고하기 위한 기념일로, 매년 3월 둘째 주 목요일로 정해 2006년부터 전세계적인 캠페인을 전개해왔다[1]. 전세계적으로 8.5억명의 인구가 콩팥질환을 앓고 있고(당뇨병 환자 4.2억명의 2배 수준), 만성콩팥병 유병률은 10%를 상회하는 것으로 알려져 있다(남자 10.4%, 여자 11.8%). 투석 치료가 필요한 콩팥병 환자는 5-10백만 명 정도로 추산되는데 많은 경우 재정적 문제로 적절한 치료를 받지 못하는 것으로 보고 있다.

2023년 3월 9일은 18번째 세계 콩팥의 날로(그림 1), 올해의 캠페인 주제는 '예상치 못한 상황 대응 계획 마련으로 취약계층 지원!(Preparing for the unexpected, supporting the vulnerable!)'으로, 지진, 전쟁, 극한 기후와 같이 예기치 못한 재난 중 만성질환자, 특히 만성콩팥병 환자 돌봄 계획 마련을 촉구하는 내용이다. 최근 코로나바이러스감염증-19 대유행을 겪으면서 감염병도 콩팥질환의 진단, 치료, 환자 돌봄에 매우 치명적인 영향을 줄 수 있음을 직접적으로 확인하기도 했다. 재난 상황에서도 만성콩팥병 환자를 적절히 관리하기 위한 계획을 마련함에 있어, 정부와 정책입안자는 응급상황에서 만성콩팥병 환자를 포함한 만성질환자의 진단과 치료 계획을 수립하고 예방을 위한 대책 시행도 추진해야 하며, 의료계는 응급상황에서도 환자 돌봄을 지속 제공할 수 있어야 하며, 환자도 응급상황에 대비하여 식품, 물, 의약품, 진료기록 등을 갖추어 두는 것이 필요하다.

세계 콩팥의 날을 맞아, ISN과 IFKF는 올해의 캠페인 이미지 등 홍보물을 마련하고, 각 국가 및 지역에 맞는 캠페인

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기획에 필요한 활동 가이드북도 마련하여 배포하였다. 질병관리청은 우리나라도 19세 이상 성인의 만성콩팥병 유병률이 8.4% (2021년 기준)이며 만성콩팥병의 원인이 되는 당뇨병과 고혈압을 앓고 있는 환자가 상당함을 고려하여(당뇨병 유병률 13.6%, 고혈압 유병률 28.1%) [2], 세계 콩팥의 날을 계기로 대한의학회 등 8개 학회가 참여하여 마련한 만성콩팥병 예방관리수칙 「나와 가족을 위한 만성콩팥병 예방과 관리 정보」리플릿을 배포하였다(그림 2) [3,4]. 예방관리수칙은 총 10개 항목으로 구성되어 있는데, 7개 수칙은 만성콩팥병 환자뿐 아니라 일반인도 지켜야 할 공통수칙이며 3개는 만성콩팥병 환자에게만 적용되는 수칙이다. 만성콩팥병은 당뇨병이나 고혈압이 원인이 되는 경우가 많기 때문에 '고혈압과 당뇨병을 꾸준히 치료합니다'가 제1의 수칙이 되었으며, 적정 체중 유지, 음식은 싱겁게 섭취, 꾸준한 신체활동 권장, 금연 및 절주, 적절 수준의 수분 섭취, 단백뇨와 크레아티닌 수치 정기검진이 공통수칙에 포함되었다. 만성콩팥병 환자를 위한 수칙에는 단백질 섭취 주의, 칼륨 섭취 주의, 약 복용 주의에 대한 내용으로 구성되었다. 만성콩팥병은 당뇨병, 고혈압, 비만 등에 의해서 발생하기도 하고, 만성콩팥병이 독립적으로 심뇌혈관질환 발생의 위험요인이기도 하기 때문에 예방관리수칙은 관련 질환의 예방관리사업을 통해서도 두루 활용할 계획이다.

그림 1. 2023년 세계 콩팥의 날 로고
출처: International Society of Nephrology, International Federation of Kidney Foundations, 2023 (World Kidney Day: activities guide) [1].

그림 2. 「나와 가족을 위한 만성콩팥병 예방과 관리 정보」 리플릿
출처: 질병관리청, 대한의학회, 2023 ([만성콩팥병]나와 가족을 위한 만성콩팥병 예방과 관리 정보. kdca.go.kr, 알림자료-홍보자료-홍보지) [3]

그림 2. 계속

Declarations

Ethics Statement: Not applicable.

Funding Source: None.

Acknowledgments: None.

Conflict of Interest: The authors have no conflicts of interest to declare.

Author Contributions: Project administration: SK. Writing – original draft: SK. Writing – review & editing: SC, GJ, SK.

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2023 World Kidney Day

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ABSTRACT

March 9, 2023 is the 18th World Kidney Day, which is celebrated every year on the second Thursday of March. The International Society of Nephrology and the International Federation Kidney Foundations selected this year's campaign theme as 'Preparing for the unexpected, supporting the vulnerable!', and have made effort to raise awareness about kidney health.

Key words: World Kidney Day; Kidney; Chronic kidney disease; Awareness

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World Kidney Day is an international awareness campaign organized by the International Society of Nephrology (ISN) and the International Federation of Kidney Foundations (IFKF), which aims to promote awareness of the importance of kidney care. It is observed annually on the second Thursday of March, since 2006 [1]. Around 850 million people worldwide are affected by kidney disease, which is twice the number of people with diabetes mellitus (420 million). The prevalence of chronic kidney disease (CKD) is currently estimated at more than 10% (men 10.4% and women 11.8%). Approximately 5–10 million people with kidney disease require dialysis, but many of them do not have access to adequate care due to financial barriers.

This year, March 9, 2023 marks the 18th World Kidney Day (Figure 1). The theme of this year's campaign, "Preparing for the unexpected, supporting the vulnerable!", aims to raise awareness of the urgent need to develop plans to care for people with chronic diseases, particularly those with CKD, during unforeseen disasters, such as earthquakes, wars, and extreme climate conditions. The recent coronavirus disease 2019 pandemic has demonstrated the devastating impact that infectious diseases can have on the diagnosis, treatment, and care of patients with kidney diseases. To manage people with CKD adequately even during disasters, governments and policymakers must plan for the diagnosis and treatment of chronic diseases, including CKD, during emergencies, and should implement preventive measures. The healthcare community must be able to provide continued care during crises, while patients should prepare themselves with essential supplies, such as food, water, medications, and medical records, in the event of emergencies.

In commemoration of World Kidney Day, the ISN and IFKF have prepared and disseminated promotional materials, including the 2023 campaign image and activity guidebooks tailored to each country and region. In the light of the CKD

prevalence of 8.4% (as of 2021) among adults aged 19 years and older in Korea and the substantial number of people with diabetes (13.6%) and hypertension (28.1%) [2],—two conditions that contribute to the development of CKD—the Korea Disease Control and Prevention Agency has issued "Chronic Kidney Disease Prevention and Management for me and my Family" (Figure 2) [3,4]. This leaflet, created by eight academic societies, including the Korea Academy of Medical Sciences, provides 10 recommendations for the prevention and management of CKD, seven of which are applicable to both patients with CKD as well as the general population, while the remaining three are specific to patients with CKD. As CKD is often caused by diabetes or hypertension, the first recommendation is to "manage blood pressure and diabetes continuously," while other advice includes maintaining a healthy weight, reducing salt intake, engaging in physical activity, abstaining from tobacco and alcohol, drink water moderately, and routine check-ups including level of urine protein and creatinine. For patients with CKD, the recommendations focus on precautions against excessive protein and potassium intake as well as precautions regarding medications. Because CKD is often caused by diabetes, hypertension, and obesity, and CKD is an independent risk

Figure 1. 2023 World Kidney Day logo
Adapted from: International Society of Nephrology, International Federation of Kidney Foundations, 2023 (World Kidney Day: activities guide) [1].

Figure 2. Chronic kidney disease prevention and management for me and my family
Adapted from : Korea Disease Control, Prevention Agency, Korea Academy of Medical Sciences, 2023 ([Chronic kidney disease] Chronic kidney disease prevention and management for me and my family, kdca.go.kr) [3].

Figure 2. Continued

factor for cardiovascular disease, CKD preventive management guidelines will be utilized in prevention projects targeting other related diseases.

Declarations

Ethics Statement: Not applicable.

Funding Source: None.

Acknowledgments: None.

Conflict of Interest: The authors have no conflicts of interest to declare.

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4. Korea Disease Control and Prevention Agency, Korean Academy of Medical Sciences. Evidence-based guideline for chronic kidney diseases in primary care. Korea Disease Control and Prevention Agency, Korea Academy of Medical Sciences; 2022.

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가공식품 선택 시 영양표시 이용률 추이, 2012–2021년

가공식품 선택 시 영양표시를 읽는 분율(초등학생 이상)은 2012년 25.0%에서 2021년 32.3%로 7.3%p 증가하였다(그림 1). 2021년을 기준으로 영양표시 이용률은 남자가 여자에 비해 낮았고, 65세 이상에서 낮았다(그림 1, 2).

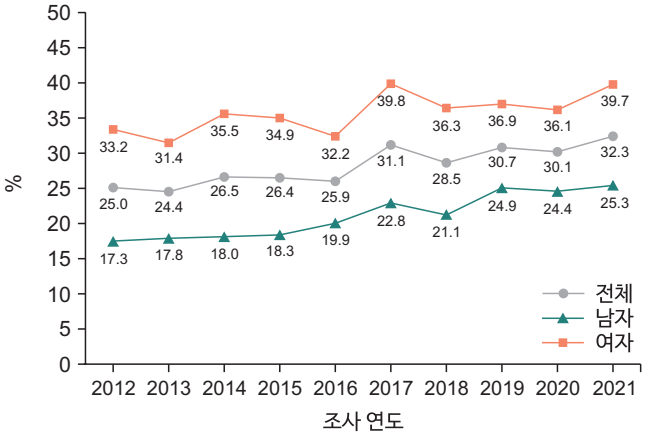

그림 1. 가공식품 선택 시 영양표시 이용률 추이, 2012–2021년

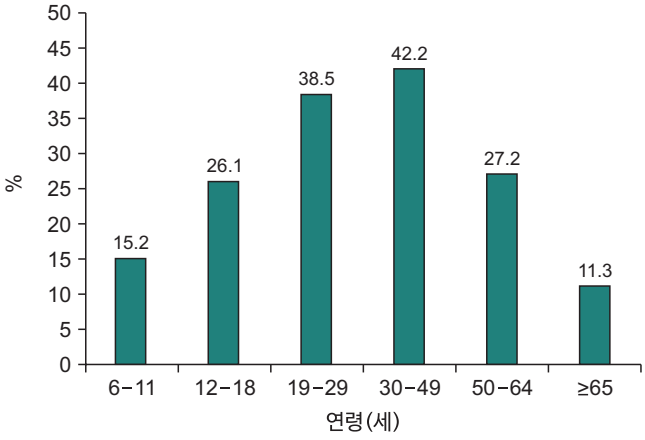

그림 2. 연령별 가공식품 선택 시 영양표시 이용률, 2021년

*가공식품 선택 시 영양표시 이용률: 가공식품 선택 시 영양표시를 읽는 분율, 초등학생 이상

†그림 1의 연도별 지표값은 2005년 추계인구로 연령표준화

출처: 2021 국민건강통계, http://knhanes.kdca.go.kr/

작성부서: 질병관리청 만성질환관리국 건강영양조사분석과

QuickStats

Trends in the Proportion of People Who Use Nutrition Facts Labels When Purchasing Processed Foods, During 2012–2021

The proportion of people who read nutrition facts labels when purchasing processed foods (among students of elementary and higher grades) increased by approximately 7.3%p, i.e., from 25.0% in 2012 to 32.3% in 2021 (Figure 1). As of 2021, the proportion of people who read nutrition facts labels was lower in men than in women, and was the lowest among those aged >65 years (Figure 1, 2).

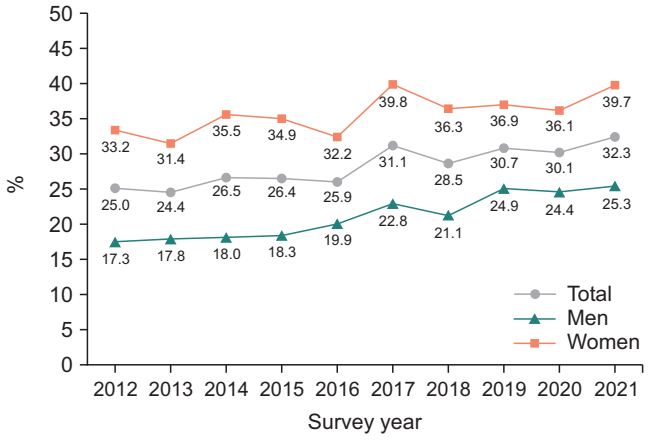

Figure 1. Trends in the proportion of people who use nutrition facts labels when purchasing processed foods, 2012–2021

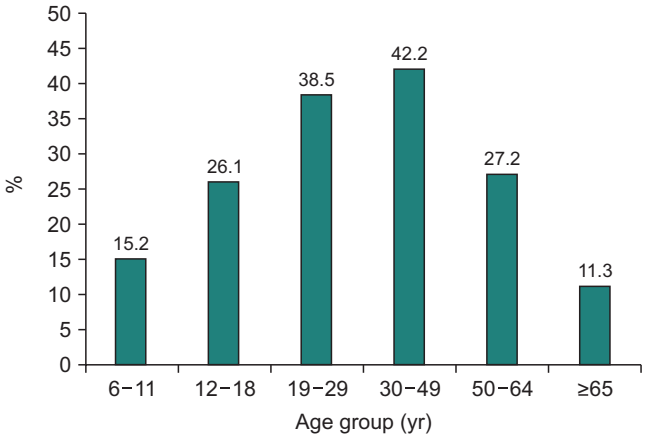

Figure 2. Proportion of people who use nutrition facts labels when purchasing processed foods based on the age group, 2021

*Proportion of people who use nutrition facts labels when purchasing processed foods: proportion of students among elementary and higher grades who read nutrition facts labels when purchasing processed foods.

†The mean in Figure 1 was calculated using age- and sex-specific structures of the estimated population in the 2005 Korea Census.

Source: Korea Health Statistics 2021, Korea National Health and Nutrition Examination Survey, http://knhanes.kdca.go.kr/

Reported by: Division of Health and Nutrition Survey and Analysis, Bureau of Chronic Disease Prevention and Control, Korea Disease Control and Prevention Agency