



## 2023-2024절기 「한랭질환 응급실감시체계」 운영 결과

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### 초 록

질병관리청은 2013년부터 전국 500여 개 응급실 운영 의료기관을 대상으로 매년 겨울철(12월-다음해 2월) 한랭질환(저체온증, 동상, 동창, 침수병·침족병 등) 발생 현황을 모니터링하고 있다. 2023-2024절기 한랭질환 응급실감시체계에는 전국 507개 기관이 참여하였고(2023년 12월 기준), 운영기간(2023. 12. 1.-2024. 2. 29.) 동안 신고된 한랭질환자는 총 400명이었으며, 그중 추정 사망자가 12명이었다. 이는 전년(447명) 대비 10.5% (47명)가 감소한 것이다. 2023년 겨울철(2023. 12.-2024. 2.) 전국 평균기온은 2.4℃로 평년(0.5℃) 대비 1.9℃ 높았고, 2023년 12월 중후반과 1월 하순 북극 주변의 찬 공기가 유입되어 일시적인 한파가 있었다. 한랭질환자는 남자(268명, 67.0%), 80세 이상(117명, 29.3%), 직업은 무직(147명, 36.8%)이 많이 보고되었고, 발생 장소는 길가(86명, 21.5%)가 가장 많았으며, 집(72명, 18.0%), 주거지 주변(57명, 14.3%)이 뒤를 이었다. 발생 시간은 하루 중 지속적으로 발생하나 특히 오전 활동 시간대인 6-12시에 전체 환자 중 34.5% (138명)가 발생하였다. 전체 환자 중 21.3% (85명)는 내원 시 음주 상태였고, 한랭질환은 저체온증(318명, 79.5%)이 가장 많았다.

**주요 검색어:** 한랭질환; 저체온증; 동상; 감시체계; 한파

### 서 론

지구 온난화는 단순히 기온 상승만을 의미하지 않고 복잡한 기후 시스템에 영향을 미쳐 예측 불가능한 극단적인 기후 현상을 유발하는데, 그중 하나가 더 강력하고 잦은 한파이다. 연구에 따르면 한파의 강도와 지속 시간은 기후변화로 인해 더욱 늘어날 것으로 예상된다[1].

한파는 겨울철에 기온이 갑자기 내려가는 기상 현상을 말하며, 기상청에서 한파일수는 아침 최저기온이 -12℃ 이하인

날을 산출하고 있다[2].

한파로 인한 건강 피해로 한랭질환이 발생하며, 한랭질환에는 저체온증, 동상, 동창, 침수병 및 침족병 등이 있다. 특히 노인, 어린이, 노숙자 등 취약계층에서 심각한 건강 문제를 유발할 수 있다[2].

2023년 2월 3-4일, 미국 북동부의 최고기온이 -44℃까지 급락하고 최저 체감온도가 -78℃에 달하는 기록적인 한파가 발생했다. 강풍으로 인한 인명 피해(1명 사망)가 발생하였으며, 보스턴, 메사추세츠주 우스터, 뉴욕주 버팔로 지역의 공

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**핵심 요약**

① 이전에 알려진 내용은?

지구 온난화는 복잡한 기후시스템에 영향을 미쳐 더 강력하고 잦은 한파를 유발한다. 한파의 강도와 지속 시간은 기후 변화로 인해 더욱 늘어날 것으로 예상된다.

② 새로이 알게 된 내용은?

한랭질환자 수는 기간별, 지역별, 개인 특성별로 차이를 보였다.

③ 시사점은?

한랭질환자 발생과 사망을 방지할 수 있도록 사전에 적절한 예방 조치하는 것이 중요하다. 이에 항상 기상예보에 주의를 기울이고 외출 시 체감온도를 확인하여 체온을 유지할 수 있도록 모자, 목도리, 장갑 등을 착용하는 등 한파 대비 건강수칙을 지키는 것이 중요하다.

립학교는 휴교령이 내려졌다. 또한, 인접한 캐나다 뉴브런즈윅, 온타리오, 토론토 일대에도 한파가 발생하였다. 영국 스코틀랜드는 2023년 3월 8일 -15℃를 기록하여 2010년 이후 3월 일최저기온 기록을 경신했다. 아시아에서는 일본, 중국, 대만, 미얀마, 아프가니스탄, 그리고 오세아니아주 호주에서 이상저온이 발생했다[3]. 주변 온도로 인한 사망 위험에 대한 다국적 관찰 연구에서 추위(7.29%, 7.02-7.49)는 더위(0.42%, 0.39-0.44)보다 사망자 비율이 더 높았으며[4], 1℃의 온도

감소는 호흡기(2.90%, 1.84-3.97) 및 심혈관(1.66%, 1.19-2.14) 질환으로 인한 사망률을 증가시켰다[5].

우리나라의 경우도 겨울철 한파일수는 한랭질환 응급실감시체계가 시작된 2013년부터 2023년까지 평균 5.3일이며, 한랭질환자는 매년 꾸준히 발생하고 있다. 한파일수와 한랭질환자 수와의 상관계수는 0.737 (p<0.01)로 매우 높았다(그림 1). 본 연구의 목적은 질병관리청에서 운영 중인 한랭질환 응급실감시체계의 결과를 환류하여 향후 공중보건 정책 수립 및 실행에 중요한 근거자료를 제공하고자 하는 것이다.

**방 법**

질병관리청은 2013년부터 한랭질환 응급실감시체계를 운영해 오고 있다. 2023-2024절기 한랭질환 응급실감시체계는 응급실을 운영하는 전국 519개(2023년 12월 기준) 의료기관 중 507개 의료기관이 감시체계에 참여(97.7%)하였으며, 한랭질환(저체온증, 동상, 동창, 침수병·침족병 등)으로 응급실에 내원한 환자를 대상으로 하고 있다(표 1). 질병관리청 질병보건통합관리시스템을 통해 보고된 자료는 관할 보건소와 시·도의 승인을 거쳐 질병관리청에서 최종 승인 후 감시 정보를 집계하는 방식으로 운영되고 있다. 감시 기간 중 수집된 정보는 기간별(일별, 누계), 지역별(시·도, 시·군·구), 주요 발생 특성별(성별, 연령별, 직업별, 질환별, 발생 시간별, 발생 장소

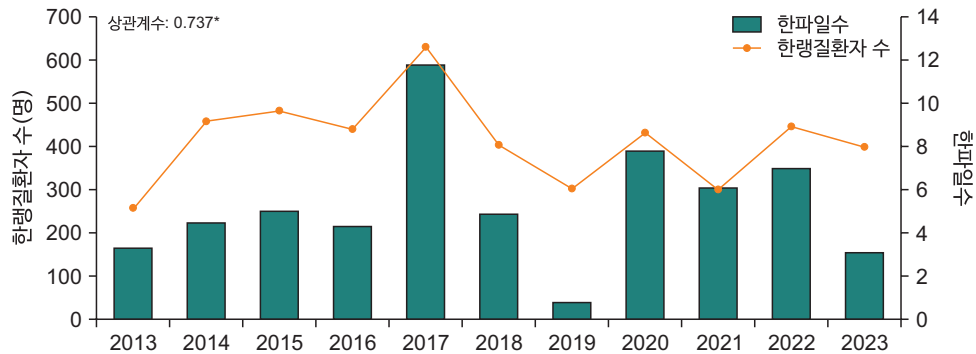


그림 1. 2013-2023년 겨울철 한파일수와 한랭질환자 수

\*p<0.01.

별)로 정리하여 매일 16시에 질병관리청 누리집에 게재하고 있다. 본 보고서는 2023년 12월 1일부터 2024년 2월 29일 까지 보고된 일별 한랭질환 감시 자료를 대상으로 주요 발생 특성별로 자료를 분석하였다.

## 결 과

2023-2024절기(2023. 12. 1.-2024. 2. 29.) 「한랭질환 응급실감시체계」로 총 400명(사망 12명)의 한랭질환자가 신

표 1. 2023-2024절기 한랭질환 응급실감시체계 주요 결과

구분	전체(%) (n=400)	국소성(%) (n=82)	전신성(%) (n=318)
성별			
남자	268 (67.0)	67 (81.7)	201 (63.2)
여자	132 (33.0)	15 (18.3)	117 (36.8)
연령별			
0-9세	7 (1.8)	3 (3.7)	4 (1.3)
10-19세	15 (3.8)	5 (6.1)	10 (3.1)
20-29세	27 (6.8)	16 (19.5)	11 (3.5)
30-39세	26 (6.5)	13 (15.9)	13 (4.1)
40-49세	23 (5.8)	7 (8.5)	16 (5.0)
50-59세	62 (15.5)	15 (18.3)	47 (14.8)
60-69세	69 (17.3)	12 (14.6)	57 (17.9)
70-79세	54 (13.5)	7 (8.5)	47 (14.8)
80세 이상	117 (29.3)	4 (4.9)	113 (35.5)
직업별			
관리자	2 (0.5)	-	2 (0.6)
전문가 및 관련 종사자	4 (1.0)	3 (3.7)	1 (0.3)
사무 종사자	11 (2.8)	4 (4.9)	7 (2.2)
서비스 종사자	9 (2.3)	2 (2.4)	7 (2.2)
판매 종사자	3 (0.8)	1 (1.2)	2 (0.6)
농림어업 숙련 종사자	6 (1.5)	1 (1.2)	5 (1.6)
기능원 및 관련 기능 종사자	-	-	-
장치기계조작 및 조립 종사자	4 (1.0)	4 (4.9)	-
단순 노무 종사자	6 (1.5)	1 (1.2)	5 (1.6)
군인	10 (2.5)	8 (9.8)	2 (0.6)
주부	18 (4.5)	1 (1.2)	17 (5.3)
학생	20 (5.0)	9 (11.0)	11 (3.5)
무직(노숙인 제외)	147 (36.8)	7 (8.5)	140 (44.0)
노숙인	6 (1.5)	2 (2.4)	4 (1.3)
미상	141 (35.3)	35 (42.7)	106 (33.3)
기타	13 (3.3)	4 (2.4)	9 (2.8)
기저질환			
유	231 (57.8)	25 (30.5)	206 (64.8)
무	169 (42.3)	57 (69.5)	112 (35.2)
미상	-	-	-
음주			
유	85 (21.3)	7 (8.5)	78 (24.5)
무	221 (55.3)	61 (74.4)	160 (50.3)
미상	94 (23.5)	14 (17.1)	80 (25.2)

표 1. 계속

구분	전체(%) (n=400)	국소성(%) (n=82)	전신성(%) (n=318)
지역별			
서울	36 (9.0)	8 (9.8)	28 (8.8)
부산	14 (3.5)	-	14 (4.4)
대구	8 (2.0)	1 (1.2)	7 (2.2)
인천	37 (9.3)	7 (8.5)	30 (9.4)
광주	1 (0.3)	-	1 (0.3)
대전	7 (1.8)	-	7 (2.2)
울산	7 (1.8)	1 (1.2)	6 (1.9)
세종	3 (0.8)	2 (2.4)	1 (0.3)
경기	74 (18.5)	26 (31.7)	48 (15.1)
강원	58 (14.5)	25 (30.5)	33 (10.4)
충북	22 (5.5)	4 (4.9)	18 (5.7)
충남	26 (6.5)	2 (2.4)	24 (7.5)
전북	19 (4.8)	1 (1.2)	18 (5.7)
전남	13 (3.3)	3 (3.7)	10 (3.1)
경북	44 (11.0)	2 (2.4)	42 (13.2)
경남	25 (6.3)	-	25 (7.9)
제주	6 (1.5)	-	6 (1.9)
발생 장소			
실외			
작업장	11 (2.8)	8 (9.8)	3 (0.9)
운동장(공원)	9 (2.3)	2 (2.4)	7 (2.2)
논/밭	8 (2.0)	-	8 (2.5)
스키장	3 (0.8)	3 (3.7)	-
스케이트장	-	-	-
산	37 (9.3)	26 (31.7)	11 (3.5)
강가, 해변	38 (9.5)	1 (1.2)	37 (11.6)
길가	86 (21.5)	9 (11.0)	77 (24.2)
주거지 주변	57 (14.3)	10 (12.2)	47 (14.8)
기타	50 (12.5)	11 (13.4)	39 (12.3)
실내			
집	72 (18.0)	5 (6.1)	67 (21.1)
건물	11 (2.8)	2 (2.4)	9 (2.8)
작업장	5 (1.3)	4 (4.9)	1 (0.3)
기타	13 (3.3)	1 (1.2)	12 (3.8)
발생 시간			
0-3시	42 (10.5)	8 (9.8)	34 (10.7)
3-6시	49 (12.3)	3 (3.7)	46 (14.5)
6-9시	75 (18.8)	9 (11.0)	66 (20.8)
9-12시	63 (15.8)	17 (20.7)	46 (14.5)
12-15시	45 (11.3)	15 (18.3)	30 (9.4)
15-18시	53 (13.3)	14 (17.1)	39 (12.3)
18-21시	38 (9.5)	9 (11.0)	29 (9.1)
21-24시	35 (8.8)	7 (8.5)	28 (8.8)

고되었으며 전년(한랭질환자 447명, 사망 12명)과 대비하여 한랭질환자는 10.5% 감소한 것으로 나타났다. 증상 발생일 기준 월별 환자 수는 1월에 196명(49.0%)으로 가장 많았고, 12월 127명(31.8%), 2월 77명(19.3%) 순으로 보고되었다. 2023-2024절기 겨울철 가장 추운 기간은 1월 하순(2024. 1. 20.-2024. 1. 31.)으로 기온 하강의 영향으로 전체 한랭질환자의 18.8%가 이 시기에 발생하였다(그림 2).

2023-2024절기 겨울철(12-2월) 기상 상황을 살펴보면, 올해 우리나라의 경우는 겨울철 전반적으로 동쪽에서 고기압성 흐름이 발달한 가운데 따뜻한 남풍이 자주 불어 평년에 비해 기온이 높았다[6]. 평균 최저기온은 -1.9℃로 지난 10년 평균 -3.7℃보다 높았고, 한파일수는 3.1일로 지난 10년 평균 한파일수 5.6일보다 감소했다. 한랭질환자 발생 수는 400명으로 지난 10년 평균 416명보다 적었고, 사망자의 경우는 12명으로 지난 10년 평균 12명과 같았다(표 2) [7].

한랭질환자 발생을 주요 발생 특성별로 살펴보면, 성별로는 남자(268명, 67.0%)가 여자(132명, 33.0%)보다 많은 것으로 나타났다. 연령별로는 80대 이상 고령층에서 117명(29.3%)으로 가장 많았고, 60대가 69명(17.3%), 50대 62명(15.5%), 70대 54명(13.5%) 순이었으며, 특히 65세 이상 노년층이 전체의 51.5%를 차지했다. 인구 10만 명당 환자 수는 80세 이상 5.1명, 70대 1.4명, 60대 0.9명, 50대 0.7명 순이었다. 직업별로는 무직이 전체 환자 중 147명(36.8%)으로 가장 많았고, 학생 20명(5.0%), 주부 18명(4.5%) 순으로 나타났다. 기저질환 유무로 살펴보면 기저질환 있는 환자가 231명(57.8%)으로 많았다. 질환별로는 보고된 한랭질환자 400명 중 전신성 질환에 해당하는 저체온증 환자는 318명(79.5%)이며, 동상 등 국소성 질환 환자는 82명(20.5%)으로 나타났다. 지역별로는 경기 74명, 강원 58명, 서울 36명, 충남 26명 순으로 많았다. 인구 10만 명당 환자 수를 보면, 강

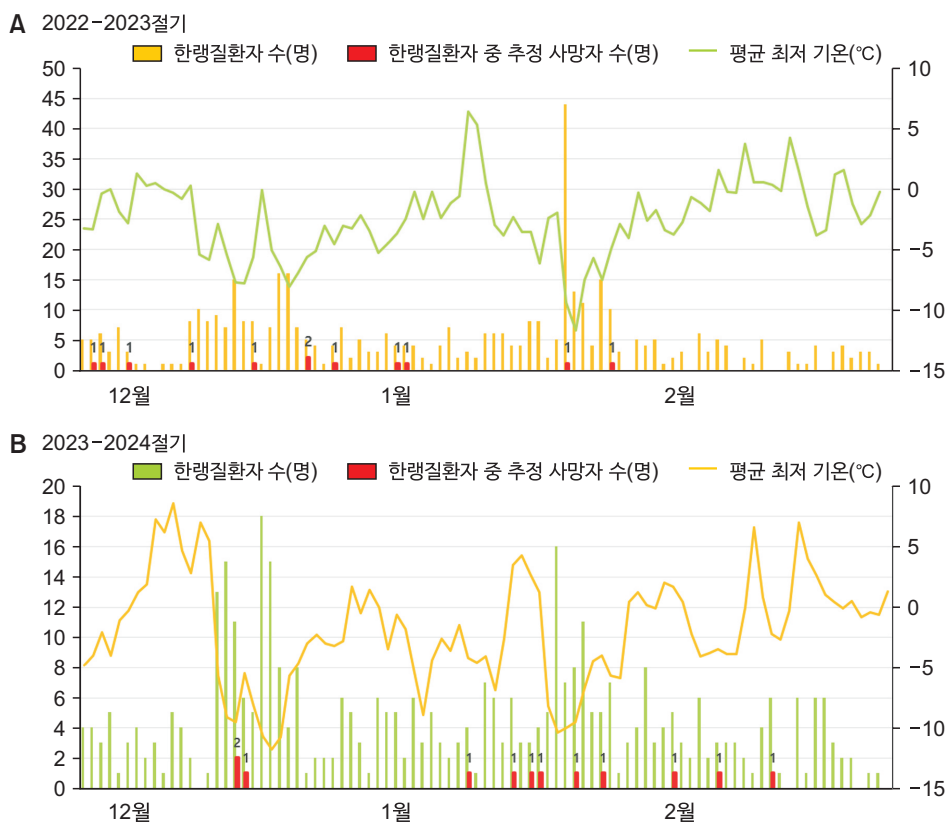


그림 2. 2022-2024절기 한랭질환 신고 현황과 평균최저기온 분포 (A) 2022-2023절기, (B) 2023-2024절기.

표 2. 최근 5년 절기별 한랭질환 응급실감시체계 운영 결과

구분	한랭질환자 수 <sup>a)</sup> (추정 사망자 수)	평균최저기온(°C)	한파일수 <sup>b)</sup>
2013-2014절기(2013. 12. 1.-2014. 2. 28.)	258 (13)	-3.2	3.3
2014-2015절기(2014. 12. 1.-2015. 2. 28.)	458 (12)	-3.6	4.5
2015-2016절기(2015. 12. 1.-2016. 2. 29.)	483 (26)	-2.7	5.0
2016-2017절기(2016. 12. 1.-2017. 2. 28.)	441 (4)	-3.2	4.3
2017-2018절기(2017. 12. 1.-2018. 2. 28.)	631 (11)	-5.5	11.8
2018-2019절기(2018. 12. 1.-2019. 2. 28.)	404 (10)	-3.4	4.9
2019-2020절기(2019. 12. 1.-2020. 2. 29.)	303 (2)	-1.4	0.8
2020-2021절기(2020. 12. 1.-2021. 2. 28.)	433 (7)	-3.9	7.8
2021-2022절기(2021. 12. 1.-2022. 2. 28.)	300 (9)	-4.8	6.1
2022-2023절기(2022. 12. 1.-2023. 2. 28.)	447 (12)	-4.8	7.0
최근 10년 평균	416 (12)	-3.7	5.6
2023-2024절기(2023. 12. 1.-2024. 2. 29.)	400 (12)	-1.9	3.1

<sup>a)</sup>한랭질환자는 ‘한랭질환 추정 사망자’를 포함하는 수치임. <sup>b)</sup>기상청 기상자료개방포털: 아침 최저기온(03:01-09:00)이 영하 12도 이하인 날의 수. Reused from the report of Lee et al. (Public Health Wkly Rep 2024;17:167-80) [7].

표 3. 2023-2024절기 한랭질환 추정 사망자 신고 현황

연번 <sup>a)</sup>	지역	성별	연령(세)
1	강원	남	98
2	강원	남	56
3	강원	여	40
4	경북	여	92
5	충남	여	88
6	경기	여	83
7	전북	여	94
8	충북	남	51
9	강원	여	79
10	전남	여	88
11	부산	남	76
12	인천	남	84

<sup>a)</sup>연번은 신고일자 순.

원 3.8명, 경북 1.7명, 충북 1.4명, 인천, 충남 각각 1.2명 순이었다. 발생 장소별로는 실외가 74.8% (299명)로 많았고, 실내(집) 18.0% (72명)를 차지하는 것으로 나타났다. 세부적으로는 실외(길가)가 86명(21.5%)으로 가장 많았고, 실내(집) 72명(18.0%), 주거지 주변 57명(14.3%) 순으로 나타났다. 발생 시간별로는 오전 6-9시 시간대(75명, 18.8%)에 가장 높은 비율을 보였다(표 1). 보고된 한랭질환 추정 사망자는 총 12

명(남자 5명, 여자 7명)으로 주로 저체온증으로 사망한 것으로 조사되었다. 추정 사망자의 평균 연령은 77.4세로, 사망자의 75.0%는 기저질환을 가진 65세 이상 노년층인 것으로 조사되었다. 지역별로는 강원 4명, 인천, 경기, 충북, 충남, 전북, 전남, 경북, 부산 각 1명이었다(표 3).

## 논 의

한랭질환은 사전에 적절한 예방 조치로 질환 발생과 사망을 방지할 수 있지만, 대처가 미흡하면 인명 피해가 발생할 수 있다. 이에 한파특보 등 기상예보에 주의를 기울여 외출 시 체감온도를 확인하고 모자, 목도리, 장갑 등을 착용하는 등 한파 대비 건강수칙을 지키는 것이 중요하다. 겨울철(12월-다음해 2월) 동안 질병관리청은 매일 오후 4시 누리집(www.kdca.go.kr)에 한파 건강 피해 발생 현황을 신속하게 제공·환류하고 있으며, 감시 종료 후에는 매년 「한파로 인한 한랭질환 신고현황 연보」를 발간하여 한파 대응 및 정책 수립의 근거 자료로 제공하고 있다. 또한 한파 대비 안내자료(포스터·카드뉴스·소책자 등)를 제작하여 한파에 의한 건강영향과 건강수

칙에 대해 적극적으로 안내하고 있다. 또한 한파영향예보 시 보도자료를 배포하여 한파로 인한 건강 피해 발생 현황과 예방수칙 등을 담아 언론 홍보를 강화하고 있다.

본 연구에서 한랭질환자와 한랭질환 추정 사망자 모두 65세 이상 노년층에서 많이 발생하고 있음을 확인하였다. 이를 해결하기 위해서는 겨울철 노년층 대상 건강수칙의 세분화와 관계부처, 지자체의 협력을 통한 적극적인 대응이 필요하다[2]. 앞으로 질병관리청은 한파로 인한 건강 피해 발생 현황을 신속하게 제공하기 위해 전국 응급실 운영기관과 보건소, 시·도와 적극적으로 협력하여 원활하게 감시체계가 운영될 수 있도록 꾸준히 노력해 나갈 계획이다.

## Declarations

**Ethics Statement:** Not applicable.

**Funding Source:** None.

**Acknowledgments:** None.

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

**Author Contributions:** Conceptualization: YJA, DSA. Formal analysis: JHL. Methodology: JHL. Visualization: JHL. Writing – original draft: JHL. Writing – review & editing: YJA, DSA.

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# Results of the 2023–2024 「Winter Cold-related Illness Emergency Room Surveillance System」

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## ABSTRACT

Since 2013, the Korea Disease Control and Prevention Agency has monitored the occurrence of cold-related illnesses (e.g., hypothermia, frostbite, chilblains, immersion disease, and immersion foot disease) every winter (i.e., December to February of the following year), targeting over 500 emergency medical institutions nationwide. A total of 507 institutions nationwide participated in the 2023–2024 seasonal cold-related illness surveillance system (as of December 2023). During the operation period (i.e., December 1, 2023, to February 29, 2024), 400 cases of cold-related illness were reported, ultimately with 12 patients presumed to have died. The total number of patients decreased by 10.5% (47 patients) compared to that of the previous year (447 patients). The national average temperature in the winter of 2023 (December 2023–February 2024) was 2.4°C, which was 1.9°C higher than the annual average of 0.5°C. A temporary cold wave occurred in mid-to-late December 2023 and late January due to the influx of cold air from the North Pole. Most patients with cold-related illnesses were male (268 patients, 67.0%), over 80 years old (132 patients, 33.0%), and unemployed (147 patients, 36.8%). The most common location of occurrence was on the roadside (86 patients, 21.5%), followed by home (72 patients, 18.0%) and residential areas (57 patients, 14.3%). The occurrence time was continuous throughout the day; however, 34.5% (138 patients) of all cases occurred during morning activity hours from 6 a.m. to 12 p.m. Of all patients, 21.3% (85 patients) were intoxicated upon presentation, and the most common cold-related illness was hypothermia (318 patients, 79.5%).

**Key words:** Cold-related illness; Hypothermia; Frostbite; Surveillance system; Cold wave

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## Introduction

Global warming involves more than just rising temperatures; it impacts the intricate climate systems, leading to more severe and unpredictable weather events, including more intense and frequent cold waves. Research indicates that the

intensity and duration of cold waves are likely to escalate due to climate change [1].

A cold wave is a meteorological event characterized by a sudden drop in winter temperatures. According to the Korea Meteorological Administration, a cold wave day is defined as a day when the minimum morning temperature falls below

**Key messages**

① What is known previously?

Global warming affects complex climate systems and causes stronger and more frequent cold waves. The intensity and duration of cold waves are expected to increase because of climate change.

② What new information is presented?

The number of patients with cold-related illnesses differed according to the period, region, and main occurrence characteristics.

③ What are implications?

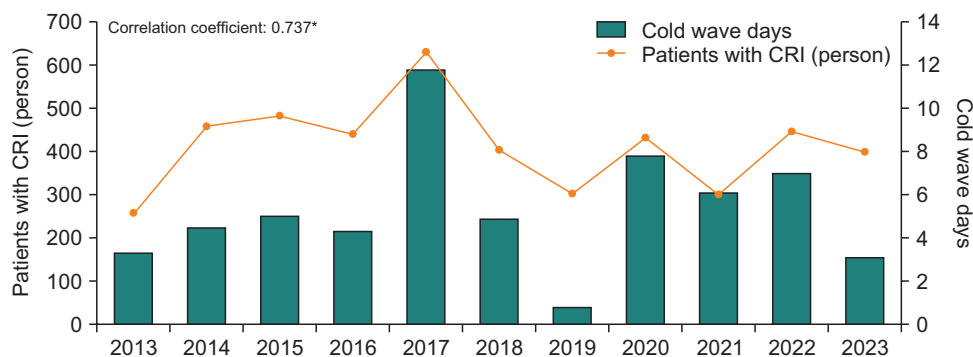
Appropriate preventive measures should be implemented to prevent the occurrences and deaths of patients with cold-related illnesses. Therefore, attention must be paid to weather forecasts, the perceived temperature when going out, and health guidelines for cold waves, such as wearing hats, scarves, and gloves to maintain body temperature.

-12°C [2].

Cold waves pose significant health risks, leading to conditions such as hypothermia, frostbite, chilblains, immersion disease, and immersion foot. These conditions are particularly severe among vulnerable populations, including the elderly, children, and the homeless [2].

On February 3–4, 2023, the Northeastern United States experienced a record-breaking cold wave, with maximum temperatures plummeting to -44°C and wind chill temperatures reaching -78°C. This extreme weather resulted in one fatality due to strong winds and led to the closure of public schools in Boston and Worcester, Massachusetts, as well as Buffalo, New York. Simultaneously, neighboring regions in Canada, including New Brunswick, Ontario, and Toronto, also experienced severe cold. In the UK, Scotland recorded a minimum temperature of -15°C on March 8, 2023, the lowest for March since 2010. Notably, unusual low temperatures were recorded across Japan, China, Taiwan, Myanmar, Afghanistan, and even Australia in Oceania [3]. A multinational study examining the mortality risks associated with ambient temperature found that deaths attributed to cold (7.29%, confidence interval [CI] 7.02–7.49) were significantly higher than those caused by heat (0.42%, CI 0.39–0.44) [4]. Additionally, a 1°C decrease in temperature was linked to an increase in mortality from respiratory diseases (2.90%, CI 1.84–3.97) and cardiovascular diseases (1.66%, CI 1.19–2.14) [5].

In the Republic of Korea (ROK), the average number of cold wave days each winter from 2013, when the cold-related illness surveillance system was established, to 2023 was 5.3



**Figure 1.** Number of cold wave days (2013–2023) and patients with CRI of winter by year  
CRI=cold-related illness. \*p<0.01.

days. During this period, there has been a consistent occurrence of patients with cold-related illnesses each year. The correlation coefficient between the number of cold wave days and

the incidence of cold-related illnesses was notably high at 0.737 ( $p < 0.01$ ) (Figure 1). This study aims to provide crucial foundational data to support the development and implementation

**Table 1.** Key results of the 2023–2024 seasonal cold-related illnesses surveillance system

Characteristic	Total (%) (n=400)	Focal (%) (n=82)	Systemic (%) (n=318)
<b>Sex</b>			
Male	268 (67.0)	67 (81.7)	201 (63.2)
Female	132 (33.0)	15 (18.3)	117 (36.8)
<b>Age (yr)</b>			
0–9	7 (1.8)	3 (3.7)	4 (1.3)
10–19	15 (3.8)	5 (6.1)	10 (3.1)
20–29	27 (6.8)	16 (19.5)	11 (3.5)
30–39	26 (6.5)	13 (15.9)	13 (4.1)
40–49	23 (5.8)	7 (8.5)	16 (5.0)
50–59	62 (15.5)	15 (18.3)	47 (14.8)
60–69	69 (17.3)	12 (14.6)	57 (17.9)
70–79	54 (13.5)	7 (8.5)	47 (14.8)
≥80	117 (29.3)	4 (4.9)	113 (35.5)
<b>Occupation</b>			
Managers	2 (0.5)	-	2 (0.6)
Professionals and related workers	4 (1.0)	3 (3.7)	1 (0.3)
Office workers	11 (2.8)	4 (4.9)	7 (2.2)
Service workers	9 (2.3)	2 (2.4)	7 (2.2)
Sales workers	3 (0.8)	1 (1.2)	2 (0.6)
Skilled agricultural, forestry and fishery workers	6 (1.5)	1 (1.2)	5 (1.6)
Functional personnel and related functional personnel	-	-	-
Equipment, machine operating and assembly workers	4 (1.0)	4 (4.9)	-
Elementary workers	6 (1.5)	1 (1.2)	5 (1.6)
Armed forces	10 (2.5)	8 (9.8)	2 (0.6)
Homemaker	18 (4.5)	1 (1.2)	17 (5.3)
Student	20 (5.0)	9 (11.0)	11 (3.5)
Unemployed (excluded homeless)	147 (36.8)	7 (8.5)	140 (44.0)
Homeless	6 (1.5)	2 (2.4)	4 (1.3)
Unknown	141 (35.3)	35 (42.7)	106 (33.3)
Other	13 (3.3)	4 (2.4)	9 (2.8)
<b>Underlying disease</b>			
Yes	231 (57.8)	25 (30.5)	206 (64.8)
No	169 (42.3)	57 (69.5)	112 (35.2)
Unknown	-	-	-
<b>Alcohol consumption</b>			
Drinker	85 (21.3)	7 (8.5)	78 (24.5)
Non-drinker	221 (55.3)	61 (74.4)	160 (50.3)
Unknown	94 (23.5)	14 (17.1)	80 (25.2)

Table 1. Continued

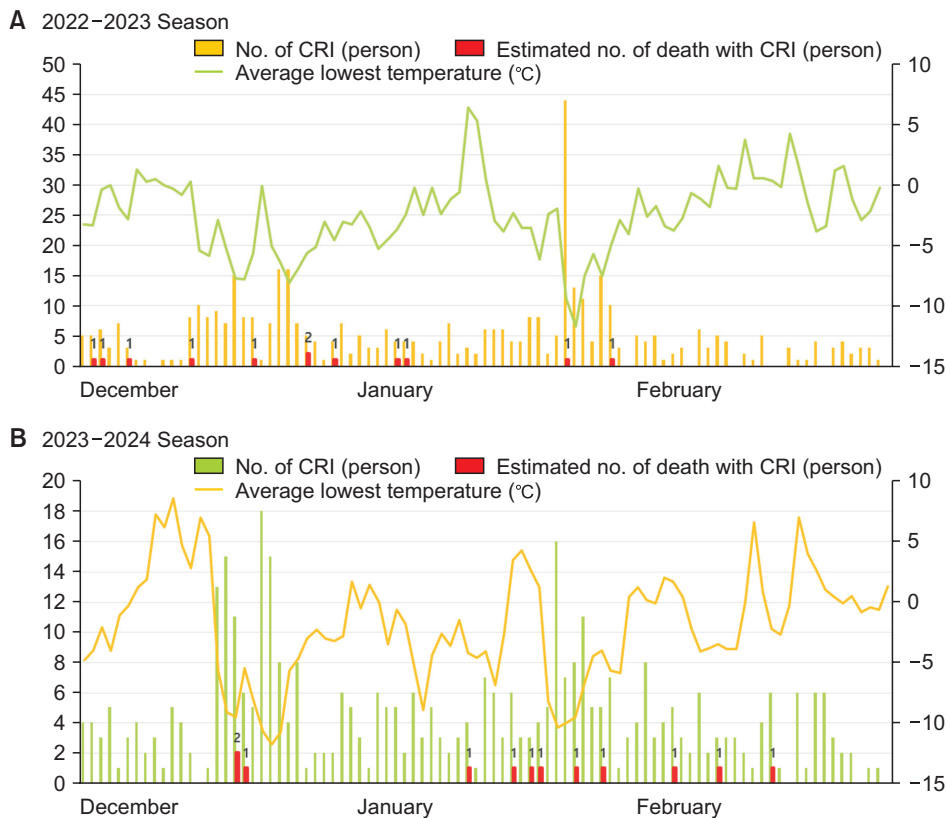
Characteristic	Total (%) (n=400)	Focal (%) (n=82)	Systemic (%) (n=318)
<b>Region</b>			
Seoul	36 (9.0)	8 (9.8)	28 (8.8)
Busan	14 (3.5)	-	14 (4.4)
Daegu	8 (2.0)	1 (1.2)	7 (2.2)
Incheon	37 (9.3)	7 (8.5)	30 (9.4)
Gwangju	1 (0.3)	-	1 (0.3)
Daejeon	7 (1.8)	-	7 (2.2)
Ulsan	7 (1.8)	1 (1.2)	6 (1.9)
Sejong	3 (0.8)	2 (2.4)	1 (0.3)
Gyeonggi	74 (18.5)	26 (31.7)	48 (15.1)
Gangwon	58 (14.5)	25 (30.5)	33 (10.4)
Chungbuk	22 (5.5)	4 (4.9)	18 (5.7)
Chungnam	26 (6.5)	2 (2.4)	24 (7.5)
Jeonbuk	19 (4.8)	1 (1.2)	18 (5.7)
Jeonnam	13 (3.3)	3 (3.7)	10 (3.1)
Gyeongbuk	44 (11.0)	2 (2.4)	42 (13.2)
Gyeongnam	25 (6.3)	-	25 (7.9)
Jeju	6 (1.5)	-	6 (1.9)
<b>Occurrence location</b>			
<b>Outdoor</b>			
Work place	11 (2.8)	8 (9.8)	3 (0.9)
Playground (park)	9 (2.3)	2 (2.4)	7 (2.2)
Farmland	8 (2.0)	-	8 (2.5)
Ski resort	3 (0.8)	3 (3.7)	-
Skating rink	-	-	-
Mountain	37 (9.3)	26 (31.7)	11 (3.5)
Riverside, beach	38 (9.5)	1 (1.2)	37 (11.6)
Roadside	86 (21.5)	9 (11.0)	77 (24.2)
Nearby residence	57 (14.3)	10 (12.2)	47 (14.8)
Other	50 (12.5)	11 (13.4)	39 (12.3)
<b>Indoor</b>			
Home	72 (18.0)	5 (6.1)	67 (21.1)
Building	11 (2.8)	2 (2.4)	9 (2.8)
Work place	5 (1.3)	4 (4.9)	1 (0.3)
Other	13 (3.3)	1 (1.2)	12 (3.8)
<b>Time of occurrence</b>			
0-3	42 (10.5)	8 (9.8)	34 (10.7)
3-6	49 (12.3)	3 (3.7)	46 (14.5)
6-9	75 (18.8)	9 (11.0)	66 (20.8)
9-12	63 (15.8)	17 (20.7)	46 (14.5)
12-15	45 (11.3)	15 (18.3)	30 (9.4)
15-18	53 (13.3)	14 (17.1)	39 (12.3)
18-21	38 (9.5)	9 (11.0)	29 (9.1)
21-24	35 (8.8)	7 (8.5)	28 (8.8)

of related public health policies in the future by analyzing and disseminating information from the cold-related illness surveillance system operated by the Korea Disease Control and Prevention Agency (KDCA).

## Methods

Since 2013, the KDCA has operated a cold-related illness surveillance system. In the 2023–2024 season, 507 (97.7%) out of 519 medical institutions with emergency departments nationwide (as of December 2023) participated in this system. It targets individuals visiting hospital emergency departments with cold-related illnesses such as hypothermia, frostbite, chilblains, immersion disease, and immersion foot, among others (Table 1). Data reported through the Integrated Disease

and Health Management System are managed and operated by obtaining initial approval from the respective public health centers and municipal/provincial governments, followed by final approval from the KDCA. This process culminates in the aggregation of related surveillance information. The collected data, organized by period (daily, cumulative), region (city/province, city/county/district), and major case characteristics (gender, age, occupation, disease, time and location of occurrence), are posted on the KDCA website daily at 4 p.m. This report analyzes data on cold-related illnesses based on these major characteristics, using daily surveillance data from December 1, 2023, to February 29, 2024.



**Figure 2.** Current status of cold-related illness and average lowest temperature distribution for the 2022–2024 winter seasons (A) 2022–2023 season, (B) 2023–2024 season. CRI=cold-related illness.

## Results

During the 2023–2024 season (December 1, 2023–February 29, 2024), the ‘cold-related illness surveillance system’ reported a total of 400 patients with cold-related illnesses, including 12 deaths. This represents a 10.5% decrease in cases compared to the previous year, which saw 447 patients and 12 deaths. The monthly breakdown of cases based on the date of symptom onset shows the highest number in January with 196 (49.0%), followed by 127 (31.8%) in December, and 77 (19.3%) in February. The coldest period of the 2023–2024 winter season occurred from January 20 to January 31, 2024, during which 18.8% of all cold-related illnesses were reported, attributed to a significant drop in temperature (Figure 2).

Regarding the weather conditions for the 2023–2024 winter season (December to February) in ROK, the overall temperature was higher than average due to a high-pressure system from the east and frequent warm southerly winds [6]. The average minimum temperature was  $-1.9^{\circ}\text{C}$ , higher than the

10-year average of  $-3.7^{\circ}\text{C}$ . Additionally, the number of cold wave days was 3.1, a decrease from the 10-year average of 5.6 days. The reported 400 cases of cold-related illnesses were lower than the 10-year average of 416, while the number of deaths remained consistent with the 10-year average of 12 (Table 2) [7].

Examining the occurrence of cold-related illness by the main characteristics of the cases revealed distinct patterns. In terms of sex, male accounted for a higher number of cases (268, 67.0%) compared to female (132, 33.0%). Age-wise, the highest incidence was among the elderly aged 80 years or older, with 117 cases (29.3%), followed by those in their 60s with 69 cases (17.3%), those in their 50s with 62 cases (15.5%), and those in their 70s with 54 cases (13.5%). Notably, patients aged 65 years or older comprised 51.5% of all cases. The incidence per 100,000 people was 5.1 in those aged 80 years or older, 1.4 in those in their 70s, 0.9 in those in their 60s, and 0.7 in those in their 50s. Regarding occupation, the unemployed represented the largest group affected, with 147 cases (36.8%),

**Table 2.** Results of the emergency room surveillance system for cold-related illnesses by season over the past five years

Winter season	Total cases <sup>a)</sup> (estimated no. of death)	Average lowest temperature ( $^{\circ}\text{C}$ )	No. of cold wave days <sup>b)</sup>
2013–2014 (2013. 12. 1.–2014. 2. 28.)	258 (13)	$-3.2$	3.3
2014–2015 (2014. 12. 1.–2015. 2. 28.)	458 (12)	$-3.6$	4.5
2015–2016 (2015. 12. 1.–2016. 2. 29.)	483 (26)	$-2.7$	5
2016–2017 (2016. 12. 1.–2017. 2. 28.)	441 (4)	$-3.2$	4.3
2017–2018 (2017. 12. 1.–2018. 2. 28.)	631 (11)	$-5.5$	11.8
2018–2019 (2018. 12. 1.–2019. 2. 28.)	404 (10)	$-3.4$	4.9
2019–2020 (2019. 12. 1.–2020. 2. 29.)	303 (2)	$-1.4$	0.8
2020–2021 (2020. 12. 1.–2021. 2. 28.)	433 (7)	$-3.9$	7.8
2021–2022 (2021. 12. 1.–2022. 2. 28.)	300 (9)	$-4.8$	6.1
2022–2023 (2022. 12. 1.–2023. 2. 28.)	447 (12)	$-4.8$	7.0
Average of the last 10 years	416 (12)	$-3.7$	5.6
2023–2024 (2023. 12. 1.–2024. 2. 29.)	400 (12)	$-1.9$	3.1

<sup>a)</sup>Total cases including death cases. <sup>b)</sup>Korea Meteorological Administration Open Meteorological Data Portal: number of days with the lowest morning temperature (03:01–09:00) below  $-12$  degrees Celsius. Reused from the report of Lee et al. (Public Health Wkly Rep 2024;17:167–80) [7].

followed by students with 20 (5.0%) and housewives with 18 (4.5%). Among these patients, 231 (57.8%) had underlying diseases. Regarding the type of cold-related illness, 318 (79.5%) of the 400 reported cases had systemic diseases like hypothermia, while 82 (20.5%) had focal conditions such as frostbite. Geographically, Gyeonggi reported the highest number of cases with 74, followed by Gangwon with 58, Seoul with 36, and Chungnam with 26. The incidence per 100,000 people was highest in Gangwon at 3.8, followed by Gyeongbuk at 1.7, Chungbuk at 1.4, and both Incheon and Chungnam at 1.2. Most cases occurred outdoors (74.8%, n=299), while 14.8% (n=66) occurred inside homes. The highest number of outdoor cases was roadside (86, 21.5%), followed by inside homes (72, 18.0%), and near residences (57, 14.3%). Most cases occurred between 6 a.m. and 9 a.m. (n=75, 18.8%) (Table 1). The total number of deaths presumed to be due to cold-related illness was 12 (5 males, 7 females), with hypothermia suspected as the main cause. The average age of the deceased was 77.4 years, with 75.0% being elderly individuals aged 65 years or

older with underlying diseases. Regionally, there were 4 deaths in Gangwon, and one each in Incheon, Gyeonggi, Chungbuk, Chungnam, Jeonbuk, Jeonnam, Gyeongbuk, and Busan (Table 3).

## Discussion

The occurrence of cold-related illnesses and associated deaths can be prevented with appropriate measures. However, inadequate preventive actions can result in loss of life. It is crucial to heed cold wave alerts and weather forecasts, check the wind chill temperature before going outdoors, and adhere to health guidelines for cold waves, such as wearing hats, scarves, and gloves. During the winter months (December to February), the KDCA promptly updates the status of health impacts from cold waves on its website ([www.kdca.go.kr](http://www.kdca.go.kr)) at 4 p.m. daily. After the surveillance period, it publishes an annual report on reported cases of cold-related illnesses to provide foundational data for responding to and developing policies for cold waves. Additionally, the KDCA produces informational materials such as posters, card news, and booklets to proactively educate the public about the health impacts of cold waves and the necessary precautions. The agency also strengthens its media relations by issuing press releases about the current status of health impacts from cold waves and preventive guidelines when forecasts predict significant cold wave impacts.

This study revealed that cold-related illnesses and suspected deaths predominantly affect the elderly, aged 65 and older. To address this issue, it is vital to tailor health guidelines for the elderly during the winter and foster collaboration between related ministries and local governments [2]. Moving forward, the KDCA plans to actively collaborate with hospital emergency

**Table 3.** Status of reported deaths due to cold-related illnesses in the 2023–2024 season

No. <sup>a)</sup>	Region	Sex	Age (yr)
1	Gangwon	Male	98
2	Gangwon	Male	56
3	Gangwon	Female	40
4	Gyeongbuk	Female	92
5	Chungnam	Female	88
6	Gyeonggi	Female	83
7	Jeonbuk	Female	94
8	Chungbuk	Male	51
9	Gangwon	Female	79
10	Jeonnam	Female	88
11	Busan	Male	76
12	Incheon	Male	84

<sup>a)</sup>The serial number is in order of the report date.

departments, public health centers, and municipal and provincial governments nationwide to ensure the efficient operation of the surveillance system, thereby facilitating prompt dissemination of information on health impacts from cold waves.

## Declarations

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