SKIN

IN-DEPTH REVIEW

Occupational Dermatoses in Rural America: A Review of Skin Disease Burden Among Agricultural and Outdoor Workers

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ABSTRACT

Background: Rural agricultural and manual laborers in the United States face significant occupational exposure to ultraviolet radiation, agrarian chemicals, mechanical friction, and infectious agents. All of which contribute to a broad spectrum of dermatologic conditions. Dermatologic disease in rural workers remains understudied and underserved, with limited access to preventive care, education, and early intervention.
Objective: This review synthesizes existing literature on occupational dermatoses in rural U.S. populations, highlighting key exposure types, health consequences, access disparities, and opportunities for public health intervention.
Findings: 22 studies were reviewed and grouped into four exposure categories: UV radiation, chemical irritants, frictional/mechanical stressors, and infectious exposures. UV-related dermatoses were common, with studies citing high rates of photodamage, sunburn, and skin cancer. Chemical exposures often led to allergic and irritant contact dermatitis and systemic toxicity in certain populations, especially child laborers. Frictional dermatoses were under-documented but prevalent, particularly among female and immigrant workers. Infectious conditions, including skin and soft tissue infections caused by multidrug-resistant Staphylococcus aureus, were associated with livestock contact and poor hygiene infrastructure. Structural barriers such as cost, language, and rural provider shortages further delayed care.
Conclusion: Occupational dermatoses in rural America represent a preventable yet neglected public health issue. Solutions to such issues include, but are not limited to: teledermatology, field-based screenings, community-based education, and policy reforms that prioritize equity in access to dermatologic care.

INTRODUCTION

Occupational skin diseases (OSDs) represent a significant yet underrecognized health burden in the United States workforce, disproportionately affecting rural populations engaged in agriculture, livestock handling, and outdoor manual labor. Although dermatologic conditions are among the most frequently reported work-related illnesses nationally, existing surveillance and intervention efforts have largely centered on urban and industrial environments. As a result, the unique dermatologic risks faced by rural workers, especially those involved in crop harvesting, dairy farming, pesticide application, and poultry processing, remain

underexplored despite clear patterns of hazardous exposure. Rural workers encounter a constellation of dermatologic threats, including prolonged ultraviolet (UV) radiation, direct contact with chemical agents, repetitive mechanical stress, and exposure to infectious pathogens. The majority of surveyed agricultural workers reported infrequent sunscreen use,[1] a finding echoed in nationwide reviews identifying high rates of actinic damage and skin cancer mortality among farmers.[2,3] Among youth laborers on U.S. farms, Green Tobacco Sickness, caused by nicotine absorption through the skin, remains an underregulated pediatric hazard.[4] Similarly, migrant and immigrant laborers experience a high burden of dermatologic disease related to both chemical and infectious exposures.[5-7] Beyond biological exposures, structural and social determinants amplify dermatologic risk. Latino migrant farmworkers had high rates of skin disease but rarely accessed formal healthcare, citing cost, language, and fear of job loss.[8] 23% of rural laborers experienced impaired skin-related quality of life, with visible lesions and chronic discomfort impacting work performance and mental well-being.[9] These disparities reflect broader national trends of the worsening rural-urban divides across 3,131 U.S. counties in clinical care access, insurance coverage, and health behaviors.[10]

This review addresses that gap. We evaluated 22 peer-reviewed studies on occupational dermatoses among rural workers in the United States, categorizing findings by four major exposure domains (**Table 1**). We also explore social determinants of dermatologic health, policy and access barriers, and community-rooted interventions such as teledermatology, field-based education, and protective equipment strategies. In doing so, we aim to elevate awareness, inform practice, and catalyze equity-driven reform in rural occupational dermatology.

METHODS

This review was conducted by searching PubMed, CINAHL, and Scopus for articles published between January 1, 2000, and

Table 1. Exposure Categories and Associated Dermatoses

Exposure Type	Dermatoses Identified	Example Studies	Key Notes
UV Radiation	Actinic damage, SCC, BCC, melanoma	Moeckel et al., Armitage et al.[1,3]	High sunburn rates, sunscreen underuse
Chemical	Contact dermatitis, GTS, acne	McKnight et al., Hinckley et al.[4,11]	Pesticides, solvents, poor PPE
Friction/Mechanical	Intertrigo, calluses, lichenification	Fenton et al., Feldman et al.[8,21]	Gendered risk, underreported
Infectious	MRSA, SSTIs, tinea	Nadimpalli et al., Pichardo-Geisinger et al.[6,31]	Livestock exposure, poor hygiene access

March 31, 2025. The search strategy included terms related to occupational skin diseases (e.g., “occupational dermatoses,” “contact dermatitis,” “photodermatoses,” “skin neoplasms”), and rural or agricultural occupations (e.g., “farmers,” “pesticide applicators,” “rural workers”). Studies were eligible for inclusion if they examined dermatologic conditions associated with chemical, UV, or mechanical/frictional exposures in rural agricultural populations. Articles focusing solely on non-rural populations or non-occupational dermatoses were excluded. Additional relevant articles were identified through reference mining of included studies. 22 peer-reviewed articles were selected based on relevance and quality. A structured data extraction framework was used to collect the following from each article: author, publication year, study design, population studied, exposure type, dermatologic conditions identified, geographic setting, and key findings (Appendix 1). Studies were then thematically grouped into four main exposure categories: UV-related dermatoses, chemical-related conditions, frictional/mechanical dermatoses, and infectious skin diseases. Additional articles providing social context (e.g., access to care, disparities, or public health interventions) were integrated into the narrative to support interpretation and policy implications.

RESULTS

Chemical Exposure

Agricultural workers in rural settings are routinely exposed to a wide array of chemical agents, including pesticides, fertilizers, solvents, and plant-derived toxins. These exposures frequently result in irritant and allergic contact dermatitis (ICD/ACD), pigmentary disorders, systemic toxicities, and, in rare cases, severe dermatoses such as chloracne or phototoxic eruptions. Despite their preventable nature, chemical-related dermatoses persist in rural laborers due to insufficient personal protective equipment (PPE), poor regulatory oversight, and gaps in worker education.

An alarming example of systemic toxicity via dermal exposure is described in cases of *Green Tobacco Sickness* (GTS) among children and adolescents caused by cutaneous absorption of nicotine from wet tobacco leaves, leading to nausea, dizziness, and headache.[4] Perry et al. (2003) further emphasized that children on U.S. farms face high rates of pesticide and solvent exposure, although dermatologic manifestations in this group remain underreported in surveillance systems.[13] This data gap is especially concerning given that children’s skin is more permeable and their detoxification systems less mature than adults', making them more susceptible to both acute dermatoses and long-term sequelae from repeated chemical exposures [14]. Chemical-related irritants and allergic contact dermatitis are also highly prevalent among adult farmworkers. In a clinic-based study of 79 migrant laborers, Hinckley et al. (2008) reported a spectrum of dermatoses, including contact dermatitis, often exacerbated by poor field hygiene and inadequate handwashing stations.[11] These findings are echoed by Feldman et al. (2009), who identified dermatitis in 304 Latino migrant farmworkers in North Carolina.[8] In poultry processing facilities, inflammatory and pigmentary dermatoses among immigrant laborers were significantly associated with occupational roles involving prolonged chemical exposure and manual handling. Workers with longer employment histories were more likely to have persistent or untreated dermatoses, highlighting the cumulative effects of repeated chemical exposure in these settings.[5] Community-level

exposure risks also extend beyond the worksite. Thompson et al. (2001) described "take-home exposure" pathways in farmworker communities where pesticides and other chemical agents were inadvertently transferred to homes via contaminated clothing, boots, and equipment[12]. This phenomenon, coupled with limited access to clean laundry facilities or PPE, increases secondary risk to children and vulnerable household members.

Across these studies, a consistent pattern emerges: inadequate PPE use. Despite established Occupational Safety and Health Administration (OSHA) standards, many agricultural and food processing employers fail to provide or mandate gloves, protective clothing, or post-exposure hygiene protocols. This regulatory gap disproportionately harms Latinx and immigrant workers, who often occupy the highest-risk roles with the fewest protections.[15] In sum, chemical exposures remain a critical and preventable contributor to occupational dermatoses in rural America (**Table 2**).

UV Radiation Exposure

Prolonged exposure to UV radiation is a daily hazard for rural outdoor laborers and leads to a spectrum of photodermatoses, ranging from acute sunburns to skin cancers such as squamous cell carcinoma (SCC), basal cell carcinoma (BCC), and melanoma. Despite the preventable nature of many UV-related conditions, rural workers continue to face limited access to sunscreen, sun-protective clothing, and health education, resulting in high rates of both acute and chronic skin damage.

Table 2. Common Chemical Irritants in Rural Labor Settings and Their Dermatologic Impact [4,5,8,9,11-15]

Chemical Irritant	Affected Working Groups	Dermatologic Consequences
Nicotine (via dermal absorption)	Child and adolescent tobacco farmworkers	Green Tobacco Sickness (GTS), nausea, dizziness, dermatitis
Organophosphate pesticides	Pesticide applicators, migrant farmworkers	Allergic and irritant contact dermatitis, phototoxic reactions
Fungicides and fertilizers	General agricultural workers	ICD/ACD, pigmentary disorders, burns
Solvents and degreasers	Dairy and poultry processing workers	Contact dermatitis, acneiform eruptions
Disinfectants and ammonia compounds	Livestock handlers, poultry processors	Irritant contact dermatitis, chronic hand eczema
Animal-derived irritants (e.g., dander, waste)	Dairy farmworkers, animal caretakers	Urticaria, ICD from exposure to animal waste/enzymes

A 2025 cross-sectional survey of agricultural workers found that over 70% of respondents reported infrequent sunscreen use, citing reasons such as forgetting, lack of availability at the worksite, and the discomfort of greasy formulations during physical labor.[1] These behavioral and logistical barriers were compounded by an overall low perception of skin cancer risk and minimal employer support for sun safety practices. Similarly, Kearney et al. (2014) reviewed national sun safety behavior among farmers and identified a consistent underutilization of sun-protective gear, such as wide-brimmed hats and long sleeves, due in part to heat discomfort and the lack of occupational policies enforcing sun safety.[2] Epidemiologic evidence further reinforces the consequences of cumulative UV exposure. In a large cohort of 1,947 California farmers, the study found a disproportionately high rate of skin cancer–related mortality, despite overall lower mortality rates in this population compared to urban counterparts.[3] This suggests delayed diagnosis and insufficient screening, potentially due to geographic barriers, low dermatologic literacy, or limited insurance coverage for routine skin exams.

Sun protection behaviors in youth working or growing up in agricultural environments also appear inadequate. A 2010 cross-sectional survey of 219 rural high school students involved in Future Farmers of America (FFA) found that intentions to use sun protection were shaped by gender, self-efficacy, and peer norms, with many teens reporting frequent sunburns and poor adherence to sunscreen use.[16] These early behaviors can set the stage for lifelong UV-related damage, particularly among adolescents who begin outdoor work in their teens. Promisingly, several community-based interventions have shown potential for improving UV risk awareness. Chung et al. (2015) implemented an educational campaign among 34 Hispanic agricultural workers in rural San Diego County, which led to measurable improvements in melanoma awareness, risk perception, and self-efficacy in skin screening behaviors. However, the study also highlighted persistent barriers such as low income, limited insurance, and cultural norms that deprioritize preventative dermatologic care.[17] Innovative prevention models have also emerged from unexpected sectors. In Wisconsin, Reding et al. (1998) piloted an outreach effort where veterinarians were trained to deliver skin cancer education to farmers during routine livestock visits[18]. This interdisciplinary model leveraged trusted rural intermediaries and demonstrated positive behavioral outcomes, including increased sunscreen use and scheduled skin checks.

The intergenerational burden of UV exposure was also explored in a parent-child dyad study comparing rural and urban families in Utah. The research found that rural families were significantly more likely to engage in outdoor work, had lower sunscreen usage, and reported higher sunburn occurrence in both adults and children, underscoring the need for family-centered sun safety interventions.[19] Visual evidence further emphasizes the clinical burden of chronic photodamage in rural workers by presenting photographic documentation of actinic keratoses, hyperkeratosis, and pigmentary changes in agricultural laborers, capturing the visible consequences of long-term sun exposure.[20] Together, these studies reveal that rural workers in the U.S. are both overexposed to UV radiation and systematically underprotected, leading to preventable dermatologic disease and cancer burden. (**Table 3**)

Frictional and Mechanical Skin Conditions

Frictional and mechanical skin injuries are an often overlooked category of occupational dermatoses affecting rural laborers, particularly those engaged in repetitive manual tasks such as lifting, kneeling, and prolonged contact with equipment or livestock. Friction-related dermatoses, including calluses, intertrigo, blisters, lichenification, and maceration, remain underreported in the literature and largely unaddressed in occupational health protocols.

Table 3. Common Barriers to Sunscreen Use Among Rural Agricultural Workers[1,16,17]

Barrier	Description
Forgetting	Workers often forget to apply sunscreen before outdoor tasks, especially when rushing to start work
Lack of Access	Sunscreen is rarely provided by employers or available on-site during the workday
Discomfort During Labor	Many report that sunscreen feels greasy, interferes with manual labor, or causes sweating
Cost	Sunscreen is viewed as expensive or not worth the financial tradeoff for low-income workers
Low Perceived Risk	Workers, including adolescents, often underestimate the long-term risks of sun exposure

Among the few studies addressing these conditions, Fenton et al. (2010) conducted a cross-sectional survey of 624 women on American farms and found a high prevalence of frictional and mechanical skin conditions, especially among those involved in fruit and vegetable cultivation or animal handling.[21] Key risk factors included the absence of gloves, frequent contact with animals, and prolonged exposure to moisture in the form of sweat or wet clothing. These findings not only underscore the dermatologic risk associated with repetitive manual labor but also reveal gendered dimensions of exposure. Many of the women surveyed performed high-contact tasks without access to standard PPE, which is often designed for male body types or omitted entirely for non-industrial agricultural roles. Pichardo-Geisinger et al. (2013) similarly reported a significant burden of friction-related skin disorders in a community-based clinical study. Diagnoses included tinea pedis, onychomycosis, and maceration-related lesions, often located in areas exposed to continuous rubbing, moisture, and inadequate ventilation. Workers reported limited access to hygiene resources, barrier creams, or dry clothing, and many were unable to change out of sweat-soaked uniforms during long shifts.[5] These

compounding factors create a perfect storm for skin barrier breakdown, especially in hot and humid working environments where occlusive clothing traps moisture and heat. Importantly, frictional skin injuries are not merely cosmetic or superficial. Repeated trauma to the skin can compromise the barrier, creating portals of entry for infectious pathogens, exacerbating chemical absorption, and worsening comorbid conditions like eczema or fungal infections.[22,23]

There is also an implicit sociocultural barrier to recognizing frictional dermatoses in rural workers. Many workers may view blisters, calluses, or chronic irritation as a normal or inevitable consequence of manual labor, rather than as conditions that can be prevented or managed. This normalization contributes to the lack of reporting and underutilization of preventive resources.

Infectious Dermatoses

Infectious dermatoses represent another category of occupational skin disease in rural laborers. These conditions range from superficial fungal infections to potentially severe bacterial skin and soft tissue infections (SSTIs), including those caused by methicillin-resistant *Staphylococcus aureus* (MRSA). Their prevalence is driven not only by environmental exposure, such as close contact with livestock or prolonged wet work, but also by structural deficits in rural occupational health infrastructure, including poor hygiene access, minimal wound care resources, and limited access to early diagnosis and treatment.

Among the strongest evidence linking rural labor to infectious dermatoses are studies centered on livestock-exposed populations (**Table 4**). In a cross-sectional study of industrial hog operation workers and their household members, Nadimpalli et al. (2016) found a high rate of colonization with multidrug-resistant *S. aureus* (MDRSA), particularly strains lacking the *scn* gene, an indicator of livestock origin. Household members of exposed workers were also found to carry MDRSA, raising alarms about community spread beyond the occupational setting.[6] Wardyn et al. (2015) echoed these concerns in a prospective cohort of over 1,300 Iowans, revealing that swine workers were more than six times as likely to carry livestock-associated *S. aureus* compared to non-exposed controls. Several colonized individuals developed SSTIs during the study period, underscoring the transition from asymptomatic carriage to clinical disease.[7] Fungal and bacterial infections are also widespread in broader manual labor settings, particularly among poultry processors and migrant workers. A community-based clinical study of 518 poultry workers in a North Carolina plant found that over half had at least one infectious dermatosis. Common conditions included *tinea pedis*, onychomycosis, and bacterial infections.[5] Moisture, maceration, shared equipment, and extended shifts in soiled uniforms created conditions conducive to microbial overgrowth and skin barrier compromise. Notably, many affected workers lacked access to formal medical care, leading to recurrent or chronic infections.[5,6]

Infectious dermatoses should no longer be viewed as incidental or secondary issues in rural occupational health. Instead, they must be reframed as indicators of systemic gaps in protective equipment, sanitation, and access to dermatologic care. Importantly, household transmission risks must also be acknowledged, particularly in migrant and multigenerational housing environments, where resistant organisms like MRSA can spread silently and persistently.

Table 4. Livestock-exposed Populations and their Dermatologic Burdens

Author (Year)	Population	Dermatoses Identified	Key Findings
Nadimpalli et al. (2016)[6]	103 industrial hog operation workers + household members	Skin and soft tissue infections (SSTIs), MRSA colonization	MRSA colonization linked to SSTIs; mask use protective; evidence of intrafamilial spread
Wardyn et al. (2015)[7]	1,342 Iowans (swine workers vs. non-exposed)	SSTIs, livestock-associated *S. aureus* colonization	Swine workers 6x more likely to carry livestock-associated *S. aureus*; some developed active SSTIs
Pichardo-Geisinger et al. (2013)[5]	518 immigrant poultry processors/manual laborers	Tinea pedis, onychomycosis, bacterial infections	Infectious dermatoses most common diagnosis; exacerbated by moisture, friction, and poor access to care

Barriers to Diagnosis and Care in Rural Populations

While occupational skin diseases in rural workers are widespread, their diagnosis and management are often delayed or entirely missed due to significant structural barriers in rural healthcare systems. These barriers, ranging from workforce shortages and limited specialist access to transportation challenges, cost, underinsurance, and pharmacy scarcity, create a cycle of chronic disease, untreated symptoms, and worsening quality of life (QoL). Many workers relied on self-treatment, endured symptoms without care, or resorted to over-the-counter products obtained through informal channels. Factors contributing to these decisions included language barriers, immigration status concerns, economic constraints, and fear of job loss, all of which discouraged seeking professional dermatologic care.[8,29] The resulting delays in treatment often led to chronic or worsening conditions, impacting both worker productivity and long-term health outcomes.

A longitudinal analysis of social determinants of health across 3,131 U.S. counties, finding that rural regions consistently demonstrated worse clinical care indicators than their urban counterparts, including: fewer healthcare providers per capita, reduced access to preventive care, and higher rates of underinsurance.[10] Furthermore, many rural counties exist in pharmacy deserts, where access to prescription medications is severely limited by geography, supply chains, or cost, further complicating treatment adherence and continuity of care.[24] Additionally, farmers were significantly less likely to undergo preventive screenings like fecal occult blood testing or have functional smoke detectors in their homes, highlighting gaps in preventive healthcare.[30]

Another critical component of this disparity is the limited presence of dermatology specialists in rural areas. Rural residents often rely on primary care providers (PCPs), who may not receive extensive dermatologic training or may lack access to dermatopathology services. This mismatch can lead to misdiagnosis or inappropriate management. Even when referral to a specialist is recommended, long wait times and travel distance to urban centers act as significant deterrents.[25] For immigrant workers, these access gaps are further compounded by cultural and linguistic

mismatches, mistrust of healthcare institutions, and lack of culturally competent outreach. Few dermatology clinics offer interpreter services or educational materials tailored to rural Latinx or Indigenous populations, making communication about skin symptoms and treatment regimens particularly challenging.[26-28]

Altogether, the delay or absence of dermatologic care for rural workers is not a reflection of apathy or neglect on the part of patients, but rather a reflection of systemic failures in rural health policy and delivery.[25] Addressing these issues will require a multifaceted approach: expanding access to teledermatology, integrating dermatologic screening into primary care workflows, increasing funding for rural residency programs and mobile health units, and improving transportation infrastructure and insurance coverage for underserved communities. The downstream consequences of delayed dermatologic care are not limited to prolonged discomfort but extend to workforce absenteeism, reduced productivity, and chronic disability. These relationships are summarized in (**Figure 1**), which illustrates the cumulative burden of unrecognized and untreated dermatoses in rural laborers.

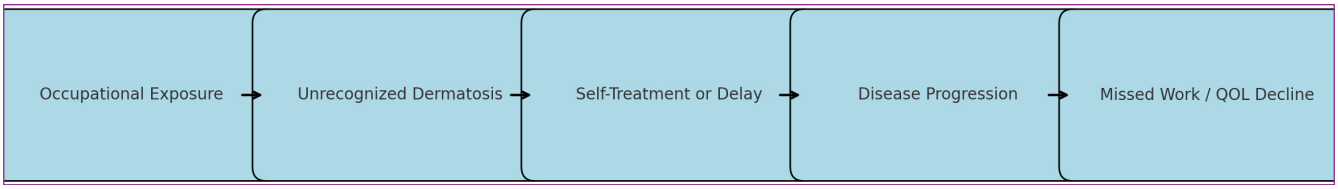

Figure 1. Consequences of Delayed Dermatologic Diagnosis in Rural Populations. This flowchart illustrates the typical progression faced by rural laborers with occupational skin conditions. Without timely recognition and access to dermatologic care, affected individuals often self-treat or delay seeking help due to systemic barriers such as underinsurance, transportation issues, and provider shortages. This leads to disease progression, reduced quality of life, and potential missed workdays, creating both individual and economic burdens.

Prevention Strategies and Policy Landscape

Federal policies led by agencies such as the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) set baseline regulations for pesticide handling, personal protective equipment (PPE) use, and worker training through programs like the Worker Protection Standard (WPS).[33] However, multiple studies suggest enforcement and implementation are inconsistent, particularly in smaller or seasonal farming operations. At the community level, mobile clinics, farmworker health fairs, and pop-up dermatology screenings have emerged as promising models to expand access in underserved areas. Teledermatology has gained traction as a scalable solution for rural access gaps.[8,11] By integrating teledermatology into primary care and migrant health networks, high-risk lesions and infections can be addressed earlier, preventing long-term sequelae. Culturally tailored education campaigns are also essential. Studies demonstrate the power of trusted community messengers from promotoras to veterinarians in delivering effective skin cancer prevention messaging and behavior change in agricultural settings.[17,18] These low-cost, high-impact interventions can be amplified by distributing sun protection gear,

gloves, and barrier creams through agricultural cooperatives or employers, a strategy that also helps normalize prevention. Finally, a significant limitation in the prevention landscape is the lack of dermatology-specific occupational surveillance data. National datasets such as the Behavioral Risk Factor Surveillance System (BRFSS) rarely collect detailed dermatologic outcomes, especially in relation to chemical or UV exposures.[34]

CONCLUSION

Occupational dermatoses remain an overlooked yet preventable health burden in rural America. Evidence reveals high prevalence rates of sunburn, contact dermatitis, fungal infections, and more severe outcomes such as skin cancer and MRSA infections, yet rural workers remain among the least protected and least served by dermatologic care systems. Systemic barriers, including workforce shortages, underinsurance, geographic isolation, and limited access to specialist care, compound these risks, contributing to delays in diagnosis, chronic disease progression, and diminished quality of life. The burden is further exacerbated among migrant, Latinx, female, and pediatric laborers, who face unique exposure patterns and structural inequities. Community-based education, mobile dermatology clinics, and teledermatology can expand reach to isolated populations. Improved PPE access, culturally tailored sun protection initiatives, and stronger policy enforcement around pesticide handling are needed to address clinical and structural gaps. Moreover, national surveillance systems and occupational health databases must be updated to capture dermatologic outcomes in rural labor populations. Ultimately, improving dermatologic outcomes for rural workers is a matter of both public health and justice. These individuals form the backbone of essential industries yet remain underserved in our health systems. A coordinated, interdisciplinary, and equity-centered response is urgently needed to ensure that the skin health of rural laborers is no longer ignored.

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Appendix 1. Data Extraction from Key Studies

Author (Year)	Study Design	Population	Exposure Type	Dermatoses Identified	Setting (Location/State)	Key Findings	Notes / Relevance
Moeckel et al. (2025)[1]	Survey (Cross-sectional)	195 agricultural workers at Pennsylvania Farm Show	UV radiation	Sunburn, photodamage (self-reported); risk awareness focus	Pennsylvania	71.8% reported infrequent sunscreen use; forgetting, lack of protection at workplace common barriers	Supports importance of UV protection education; useful for prevention and behavioral discussion
McKnight et al. (2005)[4]	Narrative review + case series	Children and adolescents on U.S. tobacco farms	Chemical (Nicotine via dermal absorption)	Green Tobacco Sickness (nausea, headache, dizziness, skin absorption of nicotine)	Kentucky and general U.S.	Children zinvolved in tobacco farming are at risk for GTS through dermal exposure to wet tobacco leaves	Highly relevant for chemical exposure section; pediatric occupational hazard
Kearney et al. (2014)[2]	Narrative review	Farmers and farmworkers in the U.S.	UV radiation	Sunburn, actinic keratoses, skin cancer risk	U.S. (general)	Identifies zoccupational sun exposure as high-risk with limited sun safety behavior among agricultural workers	Comprehensive review of sun safety and risks among U.S. agricultural populations
Hinckley et al. (2008)[11]	Clinic-based observational study	79 migrant farmworkers with skin conditions	Multiple (chemical, fungal, mechanical, environmental)	Contact dermatitis, tinea, seborrheic keratoses, melasma, impetigo	North Carolina	Skin conditions reflect both general and occupational risks; need for accessible, cost-effective treatment protocols	Valuable for describing diagnostic burden and diversity of dermatoses
Fenton et al. (2010)[21]	Cross-sectional survey	624 women on dairy farms	Animal/environmental (frictional, zoonotic)	Skin disorders from animal contact, friction-related dermatoses	Pennsylvania	Risk factors include lack of gloves, raising fruits/vegetables, and animal exposure	Adds gendered perspective on rural skin exposures; supports frictional category

Feldman et al. (2009)[8]	Prospective cohort study	304 Latino migrant farmworkers	General occupational (broad exposure)	Acne, contact dermatitis, tinea, onychomycosis	North Carolina	High burden of skin disease but extremely low formal healthcare utilization; most rely on self-treatment	Key for healthcare access and disparity discussion
Chung et al. (2015)[17]	Community-based intervention study	34 rural Hispanic/Latino adults in North San Diego County	UV radiation	Melanoma (educational focus)	California	Intervention increased awareness, risk perception, and self-efficacy in melanoma screening; SES and access barriers identified	Highlights public health strategies for UV-related risk in underserved rural Latinx populations
Cho et al. (2010)[16]	Cross-sectional survey	219 rural high school students (FFA members)	UV radiation	Sunburn (risk behavior focus)	Midwestern U.S.	Self-efficacy and peer norms predicted intentions to use sun protection; gender-specific findings relevant	Key for prevention education among rural youth; behavior-focused
Armitage et al. (2012)[3]	Cohort study	1947 California farmers	UV radiation, agricultural chemicals	Skin cancer (mortality-related)	California	Higher rates of skin cancer mortality in farmers despite overall lower mortality; linked to chronic sun exposure	Epidemiologic support for long-term sun exposure outcomes in farmers
Srinivas et al. (2023)[32]	Narrative review	Various global occupational groups (incl. agricultural)	Chemical, UV, mechanical, biological	Contact dermatitis (ICD/ACD), acne, infections, pigmentary disorders	India (global relevance)	Highlights multiple direct and indirect factors leading to occupational dermatoses; extensive mention of agricultural workers	Conceptual framework for OSD categories; useful reference but not U.S.-focused
Reding et al. (1998)[18]	Community intervention study	Farmers in Wisconsin	UV radiation	Skin cancer (prevention focus)	Wisconsin	Veterinarians can successfully deliver skin cancer education to rural farmers; positive behavioral outcomes	Innovative health education model using trusted rural intermediaries
Quandt et al. (2014)[9]	Population-based survey	733 Latino manual workers (incl. poultry processing)	Chemical, mechanical, environmental	Varied (tinea, contact dermatitis, scars); SRQOL impact	North Carolina	23% reported impaired skin-related quality of life; strong link between dermatoses and occupational risk	Key paper on SRQOL and access barriers among Latino rural workers
Probert et al. (2017)	Qualitative study (interviews)	XP patients in rural Guatemala	UV radiation (genetic disorder context)	Skin cancers in XP	Guatemala	Sunscreen use inconsistent due to cost/availability; need for education of rural providers	Not U.S.-based but valuable for rural UV exposure intervention models
Pichardo-Geisinger et al. (2013)[5]	Community-based clinical exam study	518 immigrant Latino poultry processors and manual laborers	Chemical, mechanical, infectious	Tinea pedis, onychomycosis, acne, melasma, scars	North Carolina	Infectious diseases most common (52.3%); significant prevalence of inflammatory and pigmentary disorders; occupational roles and demographics impacted rates	Highly relevant for burden of disease and occupational exposure analysis

Perry et al. (2003)[13]	Narrative review with epidemiologic data	Children living/working on U.S. farms	Chemical (pesticides, solvents), trauma, environmental	Not specifically characterized; references to skin exposures	USA (general)	Youth account for 40% of work-related fatalities among minors; high pesticide exposure risk; data lacking for dermatoses	Useful for pediatric occupational context but lacks derm-specific outcomes
Park et al. (2002)[30]	Cross-sectional analysis using BRFSS data	Iowa farmers vs. other workers	General occupational & lifestyle health risks	Not assessed	Iowa	Farmers had lower smoking rates but missed more preventive screenings; oral health better; skin conditions not reported	Not directly relevant to dermatoses; background for rural health disparities
Nadimpalli et al. (2016)[6]	Cross-sectional + lab analysis	103 industrial hog operation workers + household members	Biological (livestock-associated S. aureus)	Skin and soft tissue infections (SSTIs)	North Carolina	Workers carrying MDRSA and scn-negative strains had significantly increased SSTI risk; face mask use protective	Strong for infection-related occupational dermatoses in livestock/agricultural settings
Thompson et al. (2001)[12]	Community engagement project + qualitative analysis	Farmworker communities in Yakima Valley, WA	Chemical (pesticide exposure), take-home exposure	Not directly studied; focus on pesticide exposure routes	Washington	Community-driven strategies to reduce child exposure to pesticides; emphasized intergroup collaboration	Background context for rural chemical exposure; not dermatosis-focused
Wu et al. (2022)[19]	Cross-sectional (parent-child dyad study)	97 rural and urban families in Utah	UV radiation	Sunburn (risk behavior focus)	Utah	Rural families engaged more in outdoor work (e.g., farming), had less sunscreen use, and higher sunburn occurrence among children and adults	Strong behavioral study with implications for targeted rural sun protection interventions
Weeks et al. (2023)[10]	Cross-sectional + longitudinal health disparity analysis	3,131 U.S. counties (macro level)	Social determinants of health (indirect)	None directly	U.S. (national)	Widening rural-urban disparities in SDOH indicators from 2015–2019; worse clinical care and health behaviors in rural areas	Useful for intro/discussion on systemic barriers to care and policy needs
Wardyn et al. (2015)[7]	Prospective cohort + lab analysis	1,342 Iowans with and without livestock contact	Biological (livestock-associated *S. aureus*)	Skin and soft tissue infections (SSTIs)	Iowa	Current swine workers 6x more likely to carry MDRSA; active SSTIs observed in rural agricultural workers	High relevance for infection-based occupational dermatoses in rural livestock handlers
Watanade et al. (2023)[20]	Not specified (likely observational)	Agricultural workers in unspecified rural U.S. region	UV radiation, possibly chemical exposure	Actinic damage, hyperkeratosis, pigmentation changes	Unspecified rural U.S.	Photographic evidence of chronic sun exposure and pigmentation; suggests lack of sun protection and occupational exposure risks	Useful for visual support and clinical context; lacks methodological detail but supports narrative UV exposure theme