

RESEARCH ARTICLE

Physical strain, external demands, and work pleasure in a mobile pastoral population of the Arctic. A study of the Sámi reindeer-herder population in Norway.

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Abstract

Like other mobile pastoralists, Sámi reindeer herders possess the knowledge, skills and practical organization of an animal husbandry that manages lifestyle and production under harsh and unpredictable natural conditions.

In response to a request from the Sámi Reindeer Herder Association in Norway, we conducted a study of working and living conditions that might affect the health of the reindeer-herding population. Attempts were made to dampen the historical reluctance of the Sámis toward research by using ethical guidelines for research among indigenous people, along with the principles of participatory research. Integration of the reindeer-herding perspective and body of knowledge into the research process became a significant contribution to the researchers' lack of knowledge about the challenges, needs and problems in Sámi reindeer husbandry.

The results show that reindeer husbandry offers the community members engaging and satisfying work in a learning environment. At the same time, the exposure to bodily stresses and problem-creating external demands are high, and there are limited opportunities to recover from illness and exhaustion. There is reason to believe that those stressors threaten the reindeer herders' limits of resilience, their health and sustainable living.

Society's requirements for reindeer herding life and production system to adapt to regulations suitable to the majority resident population, may represent a persistent stressor to the culturally divergent coping strategies which enable mobile pastoralism.

Keywords: work-related health risks, indigenous, mobile pastoralists, reindeer herders, Sámi

1. Introduction

The fragile environmental and political balance of the Arctic poses a direct threat

to the approximately one million indigenous people who call the Arctic home, and who frequently are at odds with the interests of the Arctic states. Although some

treaties are in place regarding cultural rights, such as the Sámi reindeer trade in Scandinavia, when economic or political incentives of the state conflict with these rights, those incentives take priority.¹ For instance, exploitation of natural resources in northern Scandinavia for decades has greatly disrupted the Sámi reindeer trade. In addition to the challenges related to a mobile pastoral lifestyle in the Arctic climate, the reindeer herders describe a persistent stressful life situation resulting from adjustments and claims from the majority society that threatens their capacity to manage, their health and their existence as reindeer herders.² The Sámi reindeer herders in Norway have tried to elucidate their concerns, and have realized that the authorities, trade and industry, as well as the public do not understand the extent of the problems in reindeer husbandry within modern Western society.³

Mobile pastoralism is an adaption strategy of husbandry that maximizes use of natural resources in unpredictable environments and thereby permits sustainable livelihood in harsh climatic regions. Pastoralist systems are commonly organized into corporate livestock-owning units. The production is a family-based enterprise often complemented by the labor of other family members. Successful herd management involves material, relational and embodied (physical and knowledge-based) capital.⁴ The flexible interaction between nature, livestock, and labor does not correspond with planned economy or market economy. The policymakers' need for regula-

tions and predictable production ignores the body of knowledge that sustains the pastoral lifestyle, and undermines the capacity of the multiple-use management system.⁵ Limiting mobility and flexibility in pastoralism restricts the basic strategy of diversification, including spreading risk, and stretches the limits of resilience.⁶ The Sámi reindeer-herding population must allocate its capacity to the needs of reindeer husbandry in balance with the Norwegian governmental and societal claims that rest upon a quite different set of life conditions and practices.

Generally, there is a dearth of empirical evidence about health-related working and living conditions in mobile pastoral populations. The reasons for this may include the lack of or imprecise registration of individuals with a pastoral lifestyle, less-suitable procedures for recruiting informants, differences in objectives and practice between researchers and the target population, as well as mobile pastoral peoples refusal of being monitored.^{7,8} The national registers of the Sámi reindeer herders define the population by legal and economic categories, such as the right to own reindeers and formal membership in the meat-producing unit, and do not encompass the relational capital, i.e., the flexible labour of the herding unit (*siida*). Sámi research has been permeated by the research traditions developed in a period when colonialism and social Darwinism prevailed.⁹ Cultural factors have often been ignored or misinterpreted, and results become meaningless and prejudicial. Research and researchers,

therefore, suffer from a credibility gap when Sámi reindeer herders are asked to participate in studies.

1.2. Culture and health risks of mobile pastoralists.

The World Health Organization (WHO)¹⁰ defines a health risk as a factor that raises the probability of adverse health outcomes. The social determinants of health are those key aspects of people's living and working conditions and lifestyles, such as material resources, exposure to stressors, and social support or exclusion that affect wellbeing and health.¹¹ Culture is the conceptualization of the psychosocial environment in which people live, the total way of life of a group bound together by common social heritage. Culture functions both as an anchor for resilience and as an anvil of pain.¹² For example, it appears that differences in cognitive appraisal of exposure to stressful events as well as available coping strategies between indigenous and non-indigenous people both at work and otherwise are qualitative.^{13,14} The relationship between health risks and adverse health outcomes are complicated, since composite effects by aggregated exposures and cumulative risks matter.¹⁵

Despite the recognition of population-specific health risks, such as mobility in desolated areas, periodically extreme climate, working in close contact with animals, and reduced access to health services, there has been a worldwide lack of focus upon health and wellbeing in mobile

pastoralist groups. Even the world reports from WHO, for example the report on global health risks,¹⁰ do not mention those geographically and socially marginalized populations, which probably counts about 50 – 100 million people.¹⁶

Several studies show the vulnerability of mobile pastoralists due to disproportionate exposure to hazards in the physical and social environment. Studies from Africa show associations between certain diseases and climate and nutrition, as well as lack of health services and vaccinations.⁸ Studies of reindeer herders in the Arctic have revealed a high incidence of work-related deaths and accidents,^{17,18} musculoskeletal disorders,¹⁹ frost bite,²⁰ elevated blood pressure,²¹ and reduced mental health related to stressful social environments and working conditions.²²

1.3. The Sámi reindeer-herder population in Norway

The indigenous Sámis populate an Arctic area, Sápmi, which was finally divided between Norway, Sweden, Finland and Russia about 1850. For three to four hundred years, a smaller part of the Sámi population has been mobile pastoralists, guarding and caring for the reindeer herd as it moves between seasonal pastures. The establishment of national borders, increased immigration, and extended exploitation of natural resources in the Arctic region have gradually expelled the reindeers from valuable grazing land and closed important seasonal routes. In addi-

tion, laws and regulations have enforced changes in the use of land, herding procedures, meat production, and the reindeer herders' participation in civic life. In the wake of colonization of Sápmi, a program for assimilating the Sámis into the culture and lifestyle of the majority population was implemented over a period of 100 years. However, those Sámis who were engaged in reindeer herding were less affected, probably due to their mobile lifestyle and physical distance to the majority population. Even today, when modernization and new technology have brought great change to the reindeer-herding life, the government consider reindeer husbandry to be an important girder of Sámi culture.²³ Like other mobile pastoralists, the Sámi reindeer herders in Norway are geographically and socially marginalized and have less access to public services such as health services. A full knowledge of their health status is absent because their representation in registers and health surveys is imperfect or invisible.

1.4. The study

The invisibility of mobile pastoral populations causes them to fall outside the welfare systems of today's society. Therefore, it becomes important to bring forward knowledge about their health-related life conditions, and to get acquainted with the indigenous ways to face the requirements from the surrounding society. In 2012, the Sámi Reindeer Herder Association in Norway (NRL) and the Sámi Norwegian National Advisory Unit on Mental Health

and Abuse (SANKS) developed an exploratory study addressing work- and life-related factors that might affect mental health and wellbeing in the reindeer-herder population. The current article deals with data from this study, and aims to identify potential risk factors and preventive factors for poor health, related to performance of work tasks. Associations between working conditions and demographic and social role characteristics will also be described. Due to the obviously distinctive way of living and working in Sámi reindeer husbandry, and the need for data that correspond to the reindeer herders' perceptions of reality, a secondary objective of the study was to test out a participatory research model. The participatory research model had never been used in health research among Nordic indigenous people.

2. Research model, method and material

2.1. Participatory research

The researchers' lack of knowledge and experiences of the Sámi reindeer-herding world and lifestyle was a risk to the research ethics and the scientific quality of the study. To safeguard the inclusion of the reindeer-herding worldview and prevent humiliating and useless research, we had to include the reindeer-herding body of knowledge and experience into the research process. In New Zealand, Australia, Canada, and Arctic North America, guidelines and working models for collaboration between academics and indigenous communities in health research had been de-

veloped and practiced.^{24,25} There were no Nordic guidelines for indigenous research,²⁶ and we therefore used the “Guidelines for health research involving Aboriginal people” from the Canadian Institute of Health Research (CIHR).²⁷ As recommended here, we organized the process according to community-based participatory research principles.²⁸ Differences in indigenous patterns of settlements, organization, and means of livelihood as well as government policy and legislation that govern research, required some adjustments.

The CIHR guidelines are founded on the principles of ownership, access, control, and possession of cultural knowledge and aim to ensure culturally respectful research. The principles of participating research act as a supplementary navigating tool that guides the research group and the participant group through communication routines that are important to fulfill the intentions of a genuine cooperative partnership.²⁴ By integrating indigenous and scientific knowledge in a way that is meaningful to both parties, knowledge about the research issue expands and becomes more culturally accurate. The participatory research model was regulated by a written agreement between NRL and SANKS, and a cooperative research organization with a steering group, a research team, a panel of professional experts, and several focus groups. Reindeer herders and researchers engaged in all steps and at all levels of the research process from the elaboration of research questions to the selection of

methods and procedures, interpretation of the findings, and dissemination of results. A thorough review of how we implemented the guidelines and PR principles, is presented elsewhere.³

2.2. Design

The limited documentation about health-related working conditions in reindeer husbandry indicated an explorative approach. We used a qualitative design to explore burdens and coping strategies of relevance to the target population, and identify meaningful measures.²⁹ Focus group interviews were chosen as they give access to collective information that mirror local/cultural norms and assumptions.³⁰ We then used a quantitative cross-sectional design with a postal questionnaire to achieve a sufficient number of informants from the different subgroups of reindeer herders, by reasonable time and expenditures.³¹

2.3. Subjects

The target population was the adult reindeer herders who belonged to a siida-share in one of the six regions that Norwegian authorities have designated as reindeer grazing land. A siida-share consists of an extended family and the reindeers owned by those family members. It represents both a household and a production unit.

2.4. Variables and measurements

The selection and operationalization of variables was thoroughly discussed from

the academic and reindeer-herding point of view at every stage of the questionnaire construction.

Demographic variables examined included gender, age, education, household, and geographic belongingness. Age was defined by characteristics of the life phase: establishment phase from 16 to 35 years, full management phase from 36 to 55 years, and senior phase from 56 years. Education was coded on an ordinal scale differentiating highest education level at primary school, high school/vocational school, and college/university level. Based on differences in patterns of population density, as well as natural and societal premises for reindeer herding, the six grazing land regions were collapsed into western, eastern, and southern regions. Household was coded into living with family, living alone, and other.

Social roles constitute a person's social capital, and may have culture-specific meaning and affect one's health risk when exposed to health hazards.^{13,33} The social network of reindeer husbandry is related to participation in the reindeer-herding community through heredity, legal rights, type and extent of work engagement, internal economy, and social participation, as well as geographical and emotional affiliation. For this study, we asked nine questions about ownership, leadership, and kinship; eleven questions about extent and type of work participation; and six questions about sources of income. Then we constructed seven role variables: reindeer owner; leader of the *siida*-share; source of income;

participation in the herding job; participation in processing of raw material, maintenance work, and other supportive tasks; administrative negotiations with the environment and organizational work; and overall working participation. If at least one type of job was full time or at least two were part time, the overall working participation was coded as fulltime; if less, it was coded as part time; if none, it was coded as none. The time schedule in reindeer husbandry is flexible, where the changing needs of the herd, impact of natural and societal external circumstances, and available labor determine the tasks. Different jobs can hardly be measured in hours or days, but the degree of presence in the activity shows if working engagement is full time or part time.

Working condition was defined as the burdens and resilience factors presented in focus group interviews that gave meaning according to the well-established demand and control theory about work-related stress by Karasek and Theorell.³⁴ Though the reindeer herders did not address exposure to physical strain as worrisome, studies of mobile pastoralists and Nordic reindeer herders show harmful physical working environments,^{8,35} and therefore some herding-specific physical working environments were added. We asked 42 questions about exposure to strenuous physical work, noise, gases and dust, cold, and working when ill or hurt; lifetime experience with harmful accidents; work pressure by external rules; recreation; control,

and learning environment; and overall job satisfaction, work joy and stress.

A Likert scale was used for coding answers. Content value and face value of the questionnaire were evaluated by an expert panel and by a mini pilot test. Then translations into North Sámi, South Sámi, and Norwegian versions were harmonized to safeguard similarity in the connotations of wordings.

2.5. Data-collection procedures

The Sámi concept *bir'get/bearkadidh* (capability to get through what life offers) is a rooted norm that defines a person's value in Sámi reindeer-herding culture. Expressing workload and inability to manage is therefore a sensitive issue. Together with the reindeer herders' skepticism of research and the transparency of the reindeer-herding community, this required anonymous data collection. Demographic information was restricted to data that safeguarded anonymity, and the completed questionnaires were read and coded by a computer. Preparatory information about the study and data-routines were given to the reindeer herders at meetings and on a website. A letter in the Sámi and Norwegian languages was sent to all reindeer herders identified with a valid mailing address. The letter contained complementary information about the study together with the questionnaire. A reminder followed some months later. Dispatch of letters was adjusted to the less work-intensive periods in reindeer husbandry. A printed question-

naire could be answered and returned by mail or completed online (e-survey). Data collection lasted from September 2013 until September 2014.

2.6. Analyses

Taped records from five focus group interviews with fulltime reindeer herders were analyzed by bricolage qualitative procedures. Themes regarding burdens and resilience factors were extracted and information of importance to measures (culture-specific classification, wording) was noted.

All quantitative analyses were conducted in SPSS 23. Frequency analyses were used as a point of departure in focus group discourses with reindeer herders addressing elements of importance for further analyses, including construction of variables. The explorative nature of the study, together with a questionnaire where the reliability coefficient and criterion validity are unknown, justify simple statistics to prevent overrating of results. Factor analyses (principal component analyses and rotation by oblimin) extracted three scales with satisfying reliability: exposure to physical burdens (Chronbach's alpha = .83), to accidents or physical harm (Chronbach's alpha = .79), and to stressful external rules (Chronbach's alpha = .80). For descriptive purposes, frequency analyses were used. Depending on the quality of the dependent variable, the association between different working conditions and social roles were examined in series of linear stepwise regression analyses, binary regression anal-

yses (backward conditional), and multiple regression analyses (main factors). To avoid unstable results, the correlations between predictor variables were calculated, and correlated predictor variables were put in separate regression analyses. Demographic variables were used as control variables.

3. Ethics

The purpose of ethics in health research is the respect of the participants' human rights and worth, and their welfare, safety and integrity.³⁶ Ethically justifiable research is also meant to encourage commonly acknowledged norms,³⁷ and the researchers have a special responsibility for assessment of the consequences of research on small ethnic groups as they have fewer opportunities to defend their own needs and rights.³⁸ When the target group is a small indigenous population with a lifestyle apart from mainstream society cultural norms may differ significantly from Western standards. We used the Canadian guidelines for health research involving aboriginal people,²⁷ and collaborated closely with representatives from the Sámi Reindeer Herders' Association in Norway to prevent ethical violation. In the Norwegian national privacy laws, information about ethnicity is subjected to strict rules,³⁹ and access to the reindeer herder registers was given by the Ministry of

Food and Agriculture. The study was approved by the North Norwegian Ethics Committee for Health Research.

4. Results

4.1. Participants

Using data cleansing on available national registers of reindeer owners and reindeer herders, we identified 2,101 reindeer herders 16 year and older. In total, 633 reindeer herders returned the questionnaire, which gives an overall response rate of 30.1%. Among siida-share leaders, the response rate was 46.0%.

We excluded 27 respondents from the analyses due to few answered questions (< 30%) and questionable quality of responses. A description of the demographic characteristics of the subjects is provided in Table 1. The response group resembles national statistics from the reindeer-husbandry administration regarding gender distribution (F = 45%), age (mean = 40 years), and geographical distribution of reindeer herders in the western, eastern and southern regions.³² There are no previous data on education level in the reindeer-herding population; however, the reindeer herders in this study are slightly more educated than the general Norwegian population, especially in the female group, where 64% have a college- or university-level education.

Table 1. Characteristics of the response group

		N	(%)
Gender	Women	279	(46.0)
	Men	320	(43.8)
	Unknown	7	(1.2)
Life phase/age group	establishment/16 – 35 years	187	(30.9)
	Operational/ 36 – 55 years	258	(42.6)
	Senior/ 56 years and older	159	(26.2)
	Unknown	2	(.3)
Education	Primary school	189	(31.2)
	Vocational school/high school	175	(28.9)
	College/university	235	(38.8)
	Unknown	7	(1.2)
Household	Live with family members	521	(86.0)
	Living alone	60	(9.9)
	Other	15	(2.5)
	Unknown	10	(1.7)
Geographic area, grazing land region	Eastern Finnmark region	162	(26.7)
	Western Finnmark region	249	(41.1)
	Regions outside Finnmark	190	(31.4)
	Unknown	5	(.8)

Nearly all respondents participate at least part time in the business, and 75% are at least partly financially dependent upon reindeer husbandry. It was important that reindeer herders with a high degree of work

engagement participated in the study, as this group was assumed to have comprehensive experiences of reindeer-herding events and actions.

4.2 Social roles.

Table 2. Social and working characteristics of the response group and demographic factors

Role and working Characteristics	N	Rsq	Gender OR	Age OR	Education OR
Leader of family unit	243	.21	3.22***	2.07**	
Owner of reindeers	525	.11		1.85*	2.47*
Sources of income	582	.11	5.35***	1.88*	3.59***
Overall engagement					
reindeer-herding business	588	.25	2.76***		4.69***
Herding	565	.46			
Full time	221		24.59***		
Part time	267				6.25***
Processing	564	.16			
Full time	172			9.16***	4.74**
Part time	354			9.86***	6.92***
Organization work	543	.04			
Full time	84			2.51**	
	309			2.34**	

Note: Rsq refer to Nagelkerke R square; * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Work participation and sources of income of the respondents are presented in Table 2. Most respondents participate in herding jobs (80.6%), processing and supportive jobs (86.8%), and/or organizational jobs (64.7 %). Although 92.4% are engaged in the business full time or part time, 24.1% receive no income from reindeer herding.

Being male increases the probability of leadership, overall engagement in the husbandry, full-time herding, and income from the business. Higher education predicts part-time engagement and income from outside reindeer husbandry, and reindeer ownership. Age predicts full time engagement in the husbandry and leadership. Cor-

relations between participation in herding jobs and possessing supportive jobs are high ($r = .46$, $p < .001$). The association between participation in herding jobs and organizational work is more moderate ($r = .27$, $p < .001$). This suggests both a high degree of workspace overlapping and a distribution of roles between male and female; i.e., the men are more engaged in outdoor work with the animals, while the women more often engage in administrative and supportive tasks.

4.3. Work-related distress and resources

Below we present an overview of the reindeer herders' responses regarding their work conditions, and associations between job characteristics and social roles and work engagement. The demographic control variables are implemented in the analyses, and only presented as predictors if $p < .01$.

Table 3. Overall perception of work

Job characteristic	N	Agree	Partly agree	Disagree
		N (%)	N (%)	N (%)
Job satisfaction	558	459 (82.3)	89 (15.9)	10 (1.8)
Work joy	548	308 (56.2)	214 (39.1)	26 (4.7)
Occasionally loss of work joy	543	179 (32.9)	216 (39.7)	149 (27.4)
Time pressure	544	158 (29.1)	278 (51.2)	107 (19.7)
Stress	542	101 (18.6)	246 (45.4)	195 (36.0)

Compared to part-time engagement in the business, full-time engagement is associated with stress reporting (Exp (B) = 2.41, CI (95%) = 1.35 – 4.30, $p < .01$) and with occasionally loss of work joy (Exp (B) = 1.79,

CI (95%) = 1.08 – 2.98, $p < .05$). Financial dependency of the reindeer-herding business increase partial stress reporting (Exp (B) = 2.48, CI (95%) = 1.45 – 4.22, $p = .001$).

Table 4. Exposure to physical burdens

Type of exposure	N	Agree	Partly agree	Disagree
		N (%)	N (%)	N (%)
Physically strenuous	547	244 (44.6)	207(37.8)	96(17.6)
Cold	544	191 (35.1)	187(34.4)	166(30.5)
Gas, dust	544	153 (28.1)	182(33.5)	209(38.4)
Noise	528	85 (16.1)	184(34.8)	259(49.1)
Working when sick/hurt	541	221 (40.1)	205(37.9)	115(21.3)
		Several times	Sometimes	Never/once
Accidents working with animals	550	59 (10.7)	181(32.9)	227(56.4)
Accidents with vehicle	548	31 (5.7)	132(24.1)	385(70.2)
Accidents with tools	541	36 (4.8)	143(26.4)	372(68.8)

Working full time in the husbandry, as well as working with animals predict exposure to physical burdens. When controlled for demographic variables, variation in physical exposures are solely associated with gender, and men are most exposed ($t = 5.69$, $p < .001$, $B = .32$, $CI\ 95\ \% = .21 - .42$, $adj.\ R\ sq$

$= .091$). Working with animals predicts accidents and injuries, though the effect decreases when controlled for demographic variables ($t = 2.01$, $p < .05$, $B = .20$, $CI\ (95\ \%) = .00 - .39$). Here also the association to gender is most prominent ($t = .3.77$, $p < .001$, $B = .38$, $CI\ (95\%) = .18 - .57$).

Table 5. Pressure from external rules

Type of external pressure	N	Agree	Partly agree	Disagree
		N (%)	N (%)	N (%)
Interfere with work performance	546	291(53.3)	180(33.0)	75(13.7)
Prevent good solutions	540	275(50.9)	198(36.7)	67(12.4)
Decrease quality of work	545	271(49.9)	201(38.5)	63(11.6)

Most reindeer herders report pressure from external rules. However, the leaders of family units experience this pressure significantly more often than non-leaders, and

controlling for demographic variables have minor impact on the result ($t = 3.92$, $p < .001$, $B = .20$, $CI (95\%) = .10 - .30$, $Adj R sq = .26$).

Table 6. Resources

		Agree	Partly agree	Disagree
	N	N (%)	N (%)	N (%)
Learning environment	543	341(62.8)	164(30.2)	38(7.0)
Enough competence	551	316(57.4)	202(36.7)	33(6.0)
Self-determination at work	542	245(45.2)	223(41.1)	74(13.7)

Work-place resources are independent of roles and work engagement.

Table 7. Recreation over the last three years

		Sometimes	Once	Never
	N	N (%)	N (%)	N (%)
Sick leave (paid or unpaid)	545	241(44.2)	89(16.3)	215(39.4)
Make use of work substitute	518	204(39.4)	48(9.3)	266(51.4)
Vacation	531	302(56.9)	56(8.7)	183(34.5)

Sick leave occurred a little more often among the leaders than among reindeer herders without leadership ($Exp (B) = 1.56$, $CI (95\%) = 1.07 - 2.27$, $p < .05$). Taking vacation or possibility to get assistance if need for time off was not associated with roles or work participation in reindeer herding. Branding the calves is a very important annual job, economically, socially, and

emotionally, and represents an absolute threshold for ability to work or not. 82.3% have never or only once in a lifetime been absent here.

Overall, the work-related resources and burdens in reindeer herding seem to vary little by social roles or work engagement. Variations in work-related burdens seem to be predicted by full time participation, fi-

nancial dependency and/or obligation to the husbandry. In addition, male reindeer herders are particularly affected by mechanical and chemical exposures.

5. Discussion

The health of indigenous populations of the Arctic is affected by social, cultural, and economic changes brought about by interactions with Europe.⁴⁰ In addition to those external intrusions on livelihoods, the Sámi reindeer herders must face obvious physical and structural challenges associated with mobile pastoralism in a harsh terrain and extreme climate. Research has given these health risks little attention, and historically aggregated distrust between indigenous communities and the majority society may be one reason for this. Our study was founded upon the Sámi reindeer-herding viewpoint and body of knowledge, and was constructed in close cooperation with the reindeer herders. The reindeer herders' experiences were used as a point of departure for the issues that were to be explored.³ The ethical guidelines for health research involving indigenous people and procedures of participatory research were essential to develop common communication and decision-making procedures.^{27,28} A mutual learning process evolved, where the researchers received valuable knowledge about the reindeer herding way of life and the reindeer herders received scientific knowledge. This was necessary both to conduct a meaningful research project and manage the collected data, and to give the reindeer herders the possibility to supervise

how their existence was presented by outsiders, and to reduce the distrust of the researchers. The recruitment of informants as well as the persistent mutual engagement indicate that the working model suited building an authentic partnership of mutual usefulness. Previous studies also accentuate the usefulness of similar models to conduct culturally respectful research that can be used by the indigenous group.^{24,41,42}

Our informants were engaged in a wide range of tasks independent of age, gender, and education. At the same time, the results show a pattern of gender-specific roles that keep the men far away with the animals while the women stay closer to the 'baiki' (residence), acquire formal education, perform service arrangements, and support husbandry with earned money. Those characteristics of the respondent group are consistent with the holistic adjustable pattern of changing strategies and techniques that characterize mobile pastoralists, where flexibility in roles and work engagement is facilitated by the needs of the animals within changing natural conditions.^{4,5,43}

Mobile pastoralism is characterized by the symbiotic relationship between humans and their livestock and an identity as a human being defined by the welfare of the animals and the collective. The personal integrity of the reindeer herder is inseparably linked to care of the livestock. Though shrinking grazing resources, low profitability, and other conditions threatens their livelihood, they are reluctant to leave animal husbandry.⁴⁴ According to A. Antonovsky's theories of sense of coherence and stress-

management, people's global beliefs, including culturally valued enterprises, welcome challenges that make cognitive sense and increase the investment of effort.⁴⁵ Our findings show that the clear majority of reindeer herders report that working allows them to use and develop their skills and to face and cope with everyday work challenges on their own. Job satisfaction among the reindeer herders is also higher than among other employees, businesspersons or farmers in Norway.⁴⁶ Perceived competence, learning environments, and the combined effect of job satisfaction and meaningfulness are known to increase performance and satisfaction and counteract negative stress reactions.^{47,48} Thus, the results indicate that reindeer husbandry possesses an intrinsic utility of stress-preventing coping strategies.

This may explain why physical strain was downplayed as bothersome by the focus groups, though the extent of accidents, heavy lifting, and exposure to low temperatures, gases/dust, and loud noise are obvious health risks. Results from studies in neighboring Nordic countries, for instance, have shown elevated prevalence of musculoskeletal problems, frostbite, and unnatural deaths among reindeer herders.^{20,35} Our results regarding exposure to physical strain are not directly comparable to studies of other occupational groups in Norway, as the measures are different. The exposure to mechanical and chemical stressors, noise, and cold probably exceed the most vulnerable jobs in the society,⁴⁹ and is at least a strong indicator of the need for more thor-

ough examination of exposures.

A primary issue in focus groups was how external regulations complicated the ability to take care of the herd. The results showed that this was the most widespread workload regardless of gender, age, and social role. Rules introduced by the government or other public bodies that are reasonable according to the majority culture and way of life, lack the flexibility needed to apply the changing strategies fundamental to reindeer husbandry. When sustainable strategies become inaccessible, uncertainty about survival of the herd and life as reindeer herders arises. This coincides with our results, where reindeer-herding jobs that imply contact with societal authorities (participating in organization work) predict perceived stress and loss of work pleasure.

Coping refers to the way individuals try to directly or indirectly manage the experience of stress through cognitive efforts or action-oriented strategies. Mechanisms for dealing with stress that are idiosyncratically appropriate in one context may be relatively ineffective in another, and vary significantly from culture to culture, as regulated by internalized values, beliefs, and norms.⁵⁰ It is likely that the pattern of cultural coping strategies is especially vulnerable to requirements that close the possibilities to make changes in line with contextual realities. In reindeer-herding culture, psychological and practical problems are solved in the same way, by working harder and "biting the bullet," while hoping for a brighter future.⁵¹ Birget/bearkadidh (capability to get through what life offers) is a cognitive and

practical way to survive through unpredictable extreme conditions. However, societal regulations are static and withstanding persistent adversity, result in infinite overwork; that overwork threatens the limit of resilience. The reindeer herders find it difficult to explain this desperation of lacking solutions to outsiders, to whom those fixed rules and arrangements correspond with cultural norms.⁴⁶

Sámi reindeer husbandry is a lifestyle where the boundaries between business and household, work and leisure time are fluid, though this has changed because of increased technological modernization and statutory participation in the majority society. In accordance with the basic coping strategy, *birget/bearkadidh* and less distinction between work and leisure time, the reindeer herders report a low frequency of sick leave and vacations. Recreation and vacation presupposes qualified assistance, and small herding units do not hold such spare labor. Then, the culture-specific coping strategies turn into unhealthy activities when subjected to culturally disharmonious demands. Along with physical strain and external stressors, this draws a picture of a work situation that puts pressure on health conditions. The national report about health services to the Sámi population from 1995 emphasized the need for research and proposals of remedial actions due to the obvious risk of health damages caused by extensive strain.⁵² No follow-up by monitoring health risks or health status to protect against or mitigate harmful effects of exposure to health risks was implemented. It is

reasonable to conclude that marginalization of the Sámi reindeer-herder population keeps them outside the guidelines for ordinary national actions on suspicion of elevated exposure to health risks.

The relationship between work-related demands, control and social support regulates the level of stress.³⁴ The reindeer herders have for decades described a mentally stressful life situation resulting from adjustments as required by the majority society that threatens their capacity to manage and their existence as reindeer herders.² Our study shows that the most common stressor is external regulations, and it is likely to assume that the efforts to adapt too many of those regulations create a situation beyond control, and without any emotional or instrumental support from the surrounding society. The cultural gap between norms and values founded upon undisputed rules and those situation-based norms and values may act as an obstacle for supportive statements or actions from the authorities or social environments. On the other hand, despite the accumulation of new rules and regulations that induce stress, the presence of extended engagement, sense of achievement, and sense of coherence are strong health risk protectors.

There is limited information about the health condition of reindeer-herding Sámis in Norway, and therefore, we do not know if the balance between stressors and protective factors are acceptable, or if accumulation of external regulations has aggravated health. A review of studies addressing health status of the Sámi population in

Sweden identified several specific health issues in the Sámi reindeer-herding group, although there is rather similar general health in the Sámi and non-Sámi population.³⁵ The risk of fatal accidents were six to ten times as high in reindeer-herding Sámis as compared to other high-risk occupations (farmers and construction workers). Musculoskeletal disorders, frostbite, depression, and anxiety also occur more often among reindeer herders. At the same time, the review recorded lower death risk from cancer, cardiovascular diseases, and gastrointestinal diseases among Sámi reindeer herders. Findings from studies of other mobile pastoralists show both generally poor health status⁵³ and an overall health status comparable to settled populations, though an elevated level of specific diseases.⁸ Livelihood and work tasks involve significant physical strain, especially to those working directly with the animals. Our study is on line with those findings as well as the assumptions that the geographical and social marginalization of mobile pastoralist populations is preventing their health from being taken seriously by authorities.

6. Limitations and challenges

When little is known beforehand, the measures become rude. The results must be understood as over viewing descriptions of work-related issues of relevance to Sámi reindeer herders. Additionally, unidentified culture-specific qualities of data demand caution with comparison to other populations or occupational groups.

Affiliation to the reindeer-herding community varies from familiar relationship to economic dependency and full-time work in the husbandry. Respondents were recruited from available national registers that are based on individual economic interests. Though the representativeness in our respondent group seemed satisfying regarding the aim of the study, the results should not be generalized to those parts of the reindeer-herding population in Norway not counted in national registers.

Compared to national statistics of person-years in reindeer husbandry, the leaders of *siida*-units were over represented, and the work participation was twice as high in our respondent group. This may indicate that our questionnaire attracted the group of reindeer herders with high business engagement, and generalization of findings to the less business engaged part of the population should be with reservations.

Only face validity and to some degree content validity of the questionnaire was conducted. Considering the ethics related to research exhaustion of small vulnerable groups, a construct validity and reliability was not tested. Some uncertainty regarding the accuracy and stability of answers and their interpretations must be taken into account. In addition, concepts and categories of relevance to the reindeer-herding life might be invisible through the lenses of existing scientific measures. For example, flexible time and the floating transition between work and leisure time are overall qualities that are difficult to conceptualize into Western categories. Inadequacy to

translate culture-specific qualities also hampers the precision of the acquired data.

The participatory research model has been criticized for the risk of compromises on the scientific quality of the research and of encouraging researchers to behave more as spokespersons than as neutral mediators of knowledge.⁵⁴ In our study, the scope of reindeer-herding knowledge had an impact on the research issues, the instruments used, the recruitment, and the analyses. The awareness of potential criticism due to loss of scientific quality keeping this influence within the scientific framework was prominent. Nevertheless, most studies on ethnic minorities are comparative, as it is of vital interest, certainly to the political system, to be informed about national health disparities. It is a challenge to identify comparable issues/factors across lifestyle differences between the majority population and the indigenous pastoral reindeer-herding population and then to construct categories and questions of similar quality. Another challenge to comparability is to choose a comparable group of non-reindeer herders. We lack measurable criteria for belongingness to reindeer husbandry, and comparing national registers of reindeer herders with population registers or occupational registers may be misleading.

Though we have attempted to indicate explanatory connections, the cross-sectional design does not provide information to establish cause-effect relationships. That apparent simultaneity of factors should be further explored. When it comes to the interaction between specific Sámi reindeer-

herding coping strategies and external demands for adaptations, the question whether the embedded adaptation strategy of mobile pastoralism - a prerequisite for functional adjustments to the marginal and changing environments - obscures the psychosocial strain when observed by mainstream society and authorities.

7. Acknowledgements

I am grateful to the reindeer herders who made this study feasible with their information, knowledge, and assistance. I also would like to thank Inger Marit Eira-Åhrén, Vigdis Stordahl and Grete Tørrer for their contribution to the conduct of the survey and interpretation of data. Financial support was kindly provided by the Reindeer Development Fund, the Northern Norway Regional Health Department, the Sámi Parliament, the Sámi Reindeer Herders' Association of Norway, Finnmark Hospital Trust, and the Sámi National Advisory Unit on Mental Health and Substance Use.

There are no conflicts of interest or any financial benefits to report.

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