INCIDENCE AND ASSOCIATED RISK FACTORS FOR CANCER AMONG IMMIGRANTS

Major Challenges for Norway

A Review Report

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Background and Aims

Immigrants accounted for 14 % of the total population in Norway as per January 1, 2014. Twelve percent have immigrated themselves, while 2 % are Norwegian-born to immigrant parents. In some areas the proportion of immigrants is substantially higher, for example in the city of Oslo where the immigrant proportion exceeds 31% in some areas, and continues to increase rapidly.

Cancer rates have been substantially higher in high income Western countries in comparison to East-Asia and Africa. Migration studies have found that the rates of many types of cancers change when people move, especially if they move from low-incidence to high-incidence countries. This is due to a change in their lifestyle post-migration. However, for some types of cancers, migrants may be at a higher risk than the host population in the new country.

Although cancer represents a major public health problem and is the most common cause of death in men and women < 70 years of age, published data on cancer incidence among immigrants in Norway is non-existent. This is because there is no system to record the country of birth/origin in the medical record of a cancer patient. The current Cancer Registry regulations do not provide a legal basis to register such information. This precludes a systematic determination of the magnitude of the burden of cancer among immigrants. There is an urgent need for research about the magnitude of the cancer problem among immigrant groups in Norway and to make this data available to the clinicians and policy makers.

The aim of this report is to summarize findings of studies done on cancer incidence and associated risk factors pertaining to immigrants coming to Europe and North America and to identify potential challenges for Norway.

Methodology

For this review report we searched the core medical database PubMed to identify published studies on cancer among immigrants for the past 25 years. In this search we focused on immigrant groups relevant to the immigrant groups in Norway (Polish, Iraqi, Pakistani, Somalian, Iranian, and South-East Asian). We reviewed the title and the abstract and then identified a subset of studies most relevant to this report. The studies selected in this review include 15 from USA and Canada, eight from the UK, 13 from Sweden, and two each from Germany, Denmark and the Netherlands, as well as one from France.

Results and Main Findings

There is substantial variation in incidence rates across countries and ethnic groups within countries. In general, when immigrants move from a low-risk to a high-risk country, their risk of cancer increases and it starts to converge with the cancer rate in the host country. However, there are some types of cancers that have a high incidence rate in the country of origin, and immigrants may bring this high-risk with them.

Risk factors among immigrants

Certain lifestyle factors may be less common among immigrants than among the natives in high income countries. These include energy-dense diets, obesity, and alcohol. At the same time, other risk factors may be higher among certain immigrant groups, such as smoking, physical inactivity, and specific infections. Whether these factors either remain the same or change after immigration is likely to affect the specific cancer risk.

Specific Cancers

Lung cancer

Lung cancer is the most common cancer in the world and has been for several decades, as well as being the most common cause of death from cancer worldwide. The disease remains the most common cancer in men and the third most common in women. Smoking is the single most common cause of lung cancer, and smoking habits of the immigrant group determine their future incidence rate of lung cancer. With high smoking prevalence among immigrant groups, this would expect to result in increased lung cancer rates with time. Some immigrant groups have twice the smoking rate than that of Norwegians.

Breast cancer

Breast cancer is the second most common type of cancer in the world and the most frequent among women. It is the most frequent cause of death among women in low income countries. The incidence of breast cancer has traditionally been highest in high income countries and lowest in East Asia. Post-migration, the rate increases in the population moving from low incidence to high incidence areas, and has been attributed to changes in reproductive and lifestyle factors. Women from some African countries may have an earlier age at the onset of breast cancer, which means that screening should perhaps start earlier for these women.

Prostate cancer

Prostate cancer is ranked fourth overall and is the second most common cancer in men. It is the fifth most common cause of cancer death among men worldwide. It is the most frequent type of cancer in men aged over 50, and the most common cancer in many high income countries. The incidence of prostate cancer in Norway has been increasing just as in other high income countries. This may be attributable to the increased use of prostate specific antigen (PSA) screening. Men from certain African countries have an increased risk of advanced prostate cancer.

Colorectal cancer

Colorectal cancer is the third most common type of cancer in men and the second most common in women worldwide. It is the second most common type of cancer in Norway. Around 55 % of the new cases of colorectal cancer occur in regions with high income countries. The incidence of this cancer is in general low among immigrant groups. However, after migration there is a rise in the incidence and it essentially becomes similar to that of the population in the new host country.

Stomach (gastric) cancer

There is a wide geographical variation in the distribution of gastric cancer. It is the fifth most common malignancy in the world. Studies on gastric cancer among immigrants have not shown a uniform pattern. Some immigrant groups have had higher rates, in particular immigrants from Asia and South Asia. Norway has a low rate of gastric cancer. It is therefore important that Norwegian physicians are aware of this high rate in certain immigrant groups so as to avoid them from overlooking the signs and/or symptoms when it comes to this type of cancer.

Cervical cancer

Cervical cancer is ranked seventh overall and is the fourth most commonly diagnosed cancer. It is also the fourth leading cause of cancer death in females worldwide. The incidence of cervical cancer is higher in some of the less developed countries as compared to the high income countries. This is predominantly due to organized screening programs in high income countries where preinvasive stages are identified and treated. The incidence of cervical cancer in Norway has decreased over the last decades. The rates are especially high in some African

countries with no cervical cancer screening, and therefore incidence can be high among immigrant groups from these areas. It is important that these women as soon as possible after arrival in Norway start to follow the Norwegian screening guidelines.

Liver cancer

Liver cancer is the fifth most common cancer in men and the ninth in women, and is largely a problem in low income countries with > 80 % of these cancers occurring there. In particular, immigrants from Asia and East-Africa have high incidences of liver cancer as compared to the population in high income countries. The incidence rates for liver cancer is mostly determined by the distribution of chronic infection by the hepatitis B- or C-virus (HBV and HCV), but also smoking habits. Norway has a low incidence rate of liver cancer, and thus it is important that Norwegian physicians are aware of the high rates of this type of cancer among some immigrant groups.

Challenges for Norway

There is little information about cancer challenges relating to Norwegian immigrants. However, the studies reviewed here give some indication of the future challenges and possibilities.

Lifestyle factors

Many immigrant groups come from countries where lifestyle factors associated with cancer are less prevalent as compared to Norway. Previous studies suggest that lifestyle changes after migration. This means that there is a window of opportunity for intervening, i.e. to modify lifestyle changes, such as curbing obesity, maintaining a healthy weight, staying physically active and minimizing alcohol intake. If such interventions are implemented successfully, this could counteract the increased rates of lifestyle associated cancers in future. There are also some risk factors that are high in some specific immigrant groups. Studies done on Polish immigrants in the UK have reported a high incidence of drinking and a two-fold increased smoking rate as compared to the general Irish population. So it can be expected that the prevalence of smoking and drinking among Polish immigrants in Norway should be high as well. Similarly, the high prevalence of smoking among Turkish (56%) and Iranian (42%) as compared to Norwegian men (27%) is alarming. This highlights the importance of addressing smoking behavior in these groups to possibly lower the risk of lung cancer in future.

Lack of awareness

Public awareness that cervical cancer can be prevented and breast cancer outcomes can be improved through early detection is critical to improve immigrants´ participation in early detection programs. The immigrant women may not be educated to know about cervical and breast cancer risk or may have major misconceptions about the nature or curability of the disease. Cultural differences and the stigmas attached to the cancer inhibit women from disclosing the disease even to their immediate family members. Studies have revealed that women from some immigrant groups particularly those from South-Asia have very limited knowledge regarding cancer.

Screening

Insufficient knowledge about cancer screening programs in the host country is an important reason for low participation among immigrant women. There are several reasons why this task is challenging to implement in immigrant populations. It may be uncomfortable for them to discuss cervical or breast health with healthcare providers, or they may have religious or traditional customs that need to be recognized and accommodated in order to fully participate in breast or cervical cancer screening programs. Inability to communicate with the health staff due to language barrier has also been identified to be a reason for not participating in the screening program.

Conclusions

The incidence of cancer among immigrants in Norway is currently unknown and we have no means for monitoring rates systematically. It is important that the Norwegian health authorities alter legislation to make data on cancer occurrence readily available. It is also important to provide funding for research on how to prevent cancer in these groups.

The specific groups and the specific exposures and types of cancers in these groups that should be targeted are:

- High prevalence of smoking and ultimately lung cancer among specific immigrant groups
- Early onset breast cancer among immigrant women from certain Middle Eastern and certain African countries
- Prostate cancer among immigrants from certain African countries
- Norwegian physicians should be aware of the high rates of cervical, gastric, and liver cancer among immigrants from the middle eastern and northern parts of Africa, as well as immigrant groups from South and South-East Asia

- Immigrant groups should be encouraged to start following the Norwegian screening guidelines as soon as they arrive

The fact that several lifestyle related cancers occur at a lower rate among immigrant groups gives us the potential for preventing these cancers in these groups. However, in order to do so there is a strong need for lifestyle changes and preventive measures to avoid the incidence rates from converging towards that of the new host population.

Sammendrag

Innledning

Innvandrere utgjorde 14 prosent av befolkningen i Norge per 1. januar 2014. Tolv prosent har innvandret selv, mens to prosent er født i Norge med innvandrerforeldre. I enkelte områder er andelen innvandrere betydelig høyere, som for eksempel i Oslo kommune, der innvandrerandelen overstiger 31 prosent i enkelte områder, og fortsetter å øke raskt.

Tradisjonelt har forekomst av kreft vært betydelig høyere i vestlige høyinntektsland enn i Øst-Asia og Afrika. Imidlertid har studier vist at forekomst av mange kreftformer endres når folk flytter. Dette gjelder spesielt hvis de flytter fra land med lav forekomst til land med høy forekomst, idet migranter tilpasser sin livsstil i det nye landet. Likevel, når det gjelder for enkelte krefttyper kan innvandrere ha høyere risiko enn vertsbefolkningen i det nye landet.

Selv om kreft representerer et stort folkehelseproblem og er den vanligste dødsårsaken hos menn og kvinner over 70 år, så er det ingen publiserte data for kreftforekomst blant innvandrere i Norge. Dette fordi det ikke er noe system for å registrere fødeland/opprinnelse i journalen til en kreftpasient. Gjeldende regelverk for Kreftregisteret gir ikke et rettslig grunnlag for å registrere slik informasjon. Dette utelukker en systematisk fastsettelse av kreftforekomst blant innvandrere. Det er et presserende behov for forskning på dette området for å vise omfanget av kreft blant innvandrergrupper i Norge, og for å gjøre data tilgjengelige for klinikere og beslutningstakere.

Mål

Målet med denne rapporten er å oppsummere funn fra studier gjort på kreftforekomst og risikofaktorer for innvandrere til Europa og Nord-Amerika, og å identifisere potensielle utfordringer for Norge.

Metodikk

For denne oversiktsrapporten søkte vi i den medisinske databasen PubMed for å identifisere publiserte studier på kreft blant innvandrere over de siste 25 årene. I søket fokuserte vi på grupper som er relevante for de innvandrergruppene som er i Norge (polske, irakiske,

pakistanske, somaliske og iranske, samt innvandrere fra Sør-Øst Asia). Vi vurderte tittel og sammendrag og identifiserte en undergruppe av studier som var relevante for denne rapporten. Denne oversikten omfatter 15 studier fra USA og Canada, åtte fra Storbritannia, tretten fra Sverige og to hver fra Tyskland, Danmark og Nederland, og en fra Frankrike.

Resultater

Det er stor variasjon hva gjelder forekomstrater mellom land og etniske grupper innenfor landegrensene. Generelt øker risiko for kreft når innvandrere flytter fra et lav- til et høyrisikoland. Ratene konvergerer med ratene i vertslandet. Det er imidlertid noen kreftformer der ratene er høye i opprinnelseslandet, og innvandrere kan bringe økt risiko med seg.

Risikofaktorer blant i innvandrere

Visse livsstilsfaktorer kan være mindre vanlige blant innvandrere enn hos de innfødte i høyinntektsland, som for eksempel kaloririkt kosthold, fedme og alkohol. Samtidig kan andre risikofaktorer være høyere i enkelte innvandrergrupper, som røyking, fysisk inaktivitet og spesifikke infeksjoner. Avhengig av hvorvidt disse faktorene forblir de samme eller endres etter innvandring, vil trolig innvirke på om den spesifikke kreftrisiko endres.

Spesifikke kreftformer

Lungekreft

Lungekreft er den vanligste kreftformen i verden og har vært det i flere tiår. Det er også den vanligste kreftrelaterte dødsårsaken på verdensbasis. Sykdommen er den mest vanlige kreftformen hos menn, og den tredje mest vanlige blant kvinner. Røyking er den vanligste årsaken til lungekreft, og følgelig vil røykevaner blant innvandrergruppene bestemme forekomsten av lungekreft i framtiden. Det forventes at den høye utbredelsen av røyking i innvandrergrupper vil på sikt gi økte rater av lungekreft. Noen innvandrergrupper i Norge røyker dobbelt så mye som det nordmenn gjør.

Brystkreft

Brystkreft er den nest vanligste kreftformen i verden og den hyppigste kreftformen blant kvinner. Av kreftformer er den blant kvinner den hyppigste dødsårsaken i lavinntektsland. Forekomsten av brystkreft har tradisjonelt vært størst i høyinntektsland og lavest i Øst-Asia. Hyppigheten øker etter migrasjon i befolkninger som flytter fra områder med lav forekomst til områder med høy forekomst, noe som blir tilskrevet endringer ved faktorer knyttet til reproduksjon og livsstil. Kvinner fra enkelte afrikanske land kan ha en tidligere debutalder for brystkreft, noe som betyr at screening muligens burde begynne på et tidligere tidspunkt for disse kvinnene.

Prostatakreft

Prostatakreft er rangert som nummer fire samlet sett, og er den nest vanligste kreftformen hos menn. Det er den femte vanligste årsaken til kreftrelaterte dødsfall blant menn over hele verden. Prostatakreft er den hyppigste kreftform hos menn i alderen over 50, og er den vanligste kreftformen for menn i mange høyinntektsland. Forekomsten av prostatakreft i Norge har i likhet med i andre høyinntektsland vært økende. Dette kan skyldes økt bruk av prostataspesifikt antigen (PSA) screening. Menn fra enkelte afrikanske land har en økt risiko for langt framskreden prostatakreft.

Tykktarmskreft

Tykktarmskreft er den tredje vanligste kreftformen hos menn og nest vanligste blant kvinner på verdensbasis. I Norge er det den nest vanligste kreftformen. Rundt 55 prosent av nye tilfeller av tykktarmskreft forekommer i høyinntektsregioner i verden, hvilket medfører høye rater. Forekomsten av denne kreftformen er generelt lav blant innvandrergrupper. Imidlertid ser man en økning i forekomsten ved migrasjon til vestlige land. Den blir i hovedsak lik den en finner blant befolkningen i det nye vertslandet.

Magekreft

Det er stor geografisk variasjon når det gjelder forekomst av magekreft. Dette er den femte vanligste kreftformen i verden. Studier av magekreft blant innvandrere viser ikke et mønster som er likt for alle. Noen innvandrergrupper har høye rater – dette gjelder spesielt innvandrere fra Asia og Sør-Asia. I Norge er det lav forekomst av magekreft. Det er dermed viktig at

norske leger er klar over denne høye forekomsten i visse innvandrergrupper, for å unngå å overse tegn og symptomer på denne kreftformen.

Livmorhalskreft

Samlet sett rangeres livmorhalskreft som den syvende vanligste formen for kreft. Det er den fjerde vanligste kreftformen og også den fjerde største årsaken til kreftdød blant kvinner på verdensbasis. Forekomsten av livmorhalskreft er høyere i noen av lavinntektslandene sammenlignet med høyinntektsland. Dette skyldes hovedsakelig tilrettelagte screeningprogrammer i høyinntektsland, der preinvasive stadier blir identifisert og behandlet. Forekomsten av livmorhalskreft i Norge har gått ned de siste tiårene. Ratene er spesielt høye i enkelte afrikanske land, og dermed kan forekomsten også være høy blant innvandrergrupper fra disse områdene. Det er derfor viktig at disse kvinnene så snart som mulig blir fanget opp av det norske screeningprogrammet.

Leverkreft

Leverkreft er den femte vanligste kreftformen hos menn og den niende hos kvinner, og er i stor grad et problem i lavinntektsland. 80 prosent av leverkrefttilfellene finnes der. Særlig blant innvandrere fra Asia og Øst-Afrika er forekomsten av leverkreft høy. Denne forekomstraten er hovedsakelig et resultat av kroniske infeksjoner forårsaket av hepatitt B- eller C-viruset, men er i tillegg også knyttet til røykevaner. Norge har en lav forekomst av leverkreft, og derfor er det viktig at norske leger er klar over de høye tallene for denne kreftformen blant enkelte innvandrergrupper.

Utfordringer for Norge

Det er lite informasjon om kreft blant norske innvandrere. Studiene gjengitt her gir likevel noen indikasjoner på fremtidens utfordringer og muligheter.

Livsstilsfaktorer

Mange innvandrergrupper kommer fra land der kreftrelaterte livsstilsfaktorer er mindre utbredt enn i Norge. Tidligere studier antyder at livsstil endres etter utvandring. Dette skaper gode muligheter for å kunne påvirke livsstilsendringer, som for eksempel det å redusere

fedme, vedlikeholde en sunn vekt, holde seg fysisk aktiv og begrense alkoholinntak. Dersom denne typen påvirkning er vellykket, kan det motvirke økende livsstilsrelaterte kreftrater i fremtiden. I tillegg er det noen risikofaktorer som er særlig utbredt blant enkelte innvandrergrupper. Eksempelvis viser studier av polske innvandrere i Storbritannia at de har høyt alkoholinntak, og at røykeratene er dobbelt så høye som i den øvrige befolkningen i Irland. Således kan man forvente at alkoholinntaket og røykeraten er høye også hos polske innvandrere i Norge. På samme måte er røyking blant tyrkiske (56 %) og iranske (42 %) menn sammenlignet med norske menn (27 %) foruroligende. Dette viser hvor viktig det er å ta for seg røykevanene innenfor disse gruppene for muligens å kunne redusere faren for lungekreft.

Manglende bevisstgjøring

Omfattende bevisstgjøring om forebygging av livmorhalskreft og forbedring av brystkreftutfall er avgjørende for innvandreres deltakelse i ulike programmer og tiltak som kan avdekke kreft på et tidlig stadium. Muligens er innvandrerkvinnenes kunnskap om risikofaktorer knyttet til livmorhals- og brystkreft mangelfulle, eller de kan ha misforstått hvordan sykdommen utvikler seg og behandles. Kulturelle forskjeller og stigmaer forbundet med kreft avholder kvinner fra å fortelle at de har kreft, til og med til den nærmeste familien.

Undersøkelser har vist at kvinner fra visse innvandrergrupper, særlig fra Sør-Asia, har meget begrensede kunnskaper om kreft.

Screening

Utilstrekkelige kunnskaper om screeningprogrammer i vertslandet er en viktig årsak til lav deltakelse blant innvandrerkvinner. Det er flere grunner til at det kan by på problemer å få formidlet tilstrekkelig viten til innvandrergrupper på dette området. Det kan oppleves som ubehagelig å skulle snakke åpent om helsespørsmål knyttet til livmorhals og bryster med helsepersonell. Helsepersonellet må ta inn over seg og akseptere at religiøse eller andre tradisjoner også kan være til hinder for full deltagelse i screeningprogrammer. Kommunikasjonsproblemer på grunn av språkbarrierer mellom bruker og helsepersonell er også blitt pekt på som medvirkende årsak til lav deltagelse.

Konklusjoner

Kreftforekomsten blant innvandrere i Norge er dårlig kjent, og vi har få muligheter til å kunne overvåke ratene på en systematisk måte. Det er viktig at norske helsemyndigheter endrer lovverket for å gjøre data om kreftforekomst lett tilgjengelige. Det er også viktig å gi støtte til forskning på forebygging av kreft hos disse gruppene.

Innsatsen mot kreft knyttet til spesifikke grupper og rettet mot spesifikke eksponeringer i disse gruppene bør være målrettet og ta hensyn til følgende:

- Høy forekomst av røyking og tilhørende fare for lungekreft blant visse innvandrergrupper
- Tidlig debut av brystkreft blant innvandrerkvinner fra enkelte land i Afrika og Midtøsten
- Prostatakreft blant innvandrere fra enkelte afrikanske land
- Norske leger bør være klar over de høye ratene av livmorhals-, mage- og leverkreft blant innvandrere fra Midtøsten, Nord-Afrika, og fra Sør- og Sørøst-Asia
- Innvandrergrupper bør oppmuntres til å følge de norske retningslinjene for screening så snart de ankommer landet

Det faktum at flere livsstilsrelaterte kreftformer forekommer i mindre grad blant innvandrergrupper, gir oss muligheten til å etablere og igangsette forebyggende tiltak for disse gruppene. For å kunne gjøre dette er det stort behov for å påvirke i livsstilvalg og -endringer for å forhindre at forekomstratene konvergerer med den nye vertsbefolkningen.

Definitions

Age-Standardized Incidence Rates (SIR) Age-standardized (or age-adjusted) incidence rates are summary rates which would have been observed, given the age-specific rates, in a population with the age composition of a given standard population. The world standard population is used as reference.

Norwegians are defined as being born in Norway and having two Norwegian-born parents.

Host population is defined as the majority population excluding the immigrants and those of immigrant descent.

Immigrants are defined as being born abroad by two foreign-born parents, and registered as residents in Norway ("first-generation immigrants" or "migrants").

Norwegian-born to immigrant parents are defined as those born in Norway with two immigrant parents (before 2000, they were called "second-generation immigrants").

Abbreviations

ASIR Age-Standardized Incidence Rates

BMI Body Mass Index

CCS Cervical cancer screening

IR Incidence Rates

OR Odds Ratio

PIOR Proportional Incidence Odds Ratios

PSA Prostate Specific Antigen

RF Reproductive Factors

RR Rate Ratios

SES Socio-Economic Status

1. Background and Aims

1.1 Background

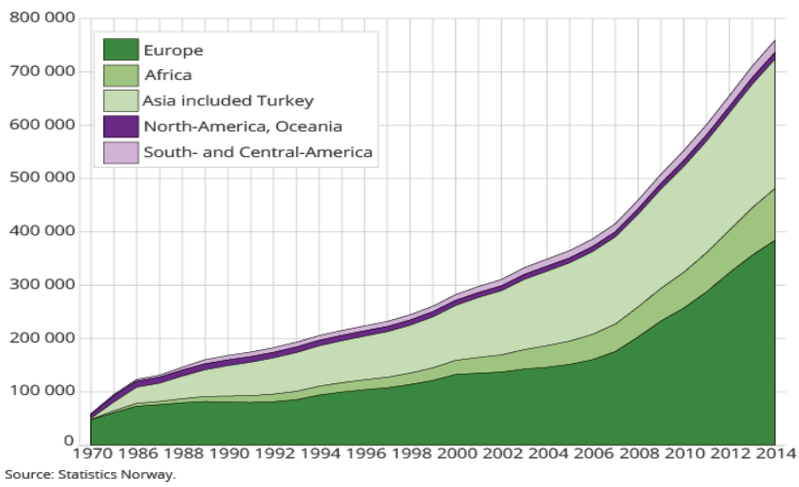
1.1.1 Immigrants in Norway

The increase in migration to Norway started about four decades ago when the wealth of oil was discovered, increasing the demand of manpower in the labor industry. The Pakistanis [1, 2], followed by the Turkish, were the two main immigrant groups in the 1970's [3]. After the introduction of the Immigration ban in 1981 [4], the status of immigrants changed from being economic migrants to being refugee and asylum-seekers. The main immigrant groups in this period came from Sri Lanka, Iran, and Iraq [3]. Thus, immigrants in Norway today are quite heterogeneous in terms of social, cultural, religious, and migration background. In 2008, SSB revised its categorization of immigrants from Western immigrants and non-Western immigrants to a country-based categorization. This was considered less discriminatory and stigmatizing.

Over the last decade there has been a rapid increase in migration to Norway. Based on the data from Statistics Norway [5], immigrants comprise around 14.1% of the total population of Norway in 2014. Immigrants in Norway come from 220 different countries and independent regions. Oslo has the highest number of immigrants and Norwegian-born to immigrant parents. Among Oslo's population of 624,000, there are 189,400 immigrants or Norwegian-born to immigrant parents, which is almost 30% percent of Oslo's inhabitants. There are also other urban areas where the proportion of immigrants is increasing rapidly. *Figure 1* shows the development of the immigrant populations by their country background since 1970.

Immigrants from Poland comprise the largest immigrant group (77,000), followed by those with Swedish background (35,600), Lithuanian (28,600), German (24,200), and Somali (24,000) [5]. The number of Norwegian-born to immigrant parents increased by 8,700 and became 117,100 during 2012 [5]. Those with Pakistani parents made up the largest group (15,200) of all Norwegian-born to immigrant parents. Norwegian-born to Somali parents were the second largest group (9,100), followed by those with parents from Vietnam (8,000). Norwegian-born to immigrant parents accounted for 17 % of all children born in Norway in 2012 [5].

Figure 1: Immigrants and Norwegian-born to immigrant parents by country background 1970-2014



1.1.2 Cancer as a public health problem

Cancer is a major public health problem globally. This disease is a leading cause of death around the world and WHO estimates that around 84 million people will die of cancer between 2005 and 2015. According to data WHO collects on incidence, prevalence, and mortality from major types of cancer, at a national level for 184 countries, 14.1 million new cancer cases were estimated to occur worldwide, and there were 8.2 million cancer-related deaths in 2012 [6]. The corresponding numbers in 2008 were 12.7 million and 7.6 million, respectively [6]. Furthermore, WHO's estimations suggest an increase to 19.3 million new cancer cases per year by 2025, due to growth and ageing of the global population [6]. More than half of all cancers (56.8%) and cancer deaths (64.9%) in 2012 occurred in regions with low income countries, and these proportions will increase further by 2025 [6].

In 2012, 30,099 new cases of cancer were recorded in Norway, of which 16,491 occurred among men and 13,608 among women [7]. Cancers of the prostate, female breast, lung, and colon were the most common cancers and accounted for 45% of the total cancer burden. In men, prostate cancer was the most frequent cancer (4,919 cases), followed by lung (1,602 cases), and colon cancer (1,294 cases). Breast cancer was the most frequent neoplasm in women, with 2,956 new cases in 2012, followed by colon and lung cancer, with 1,423 and 1,300 incident cases, respectively [7].

In *table 1*, we present incidence rates of different cancers in Norway and other geographical regions. *Figure 2a* and *Figure 2b* show the incidence of major cancers worldwide in men and women, respectively [6].

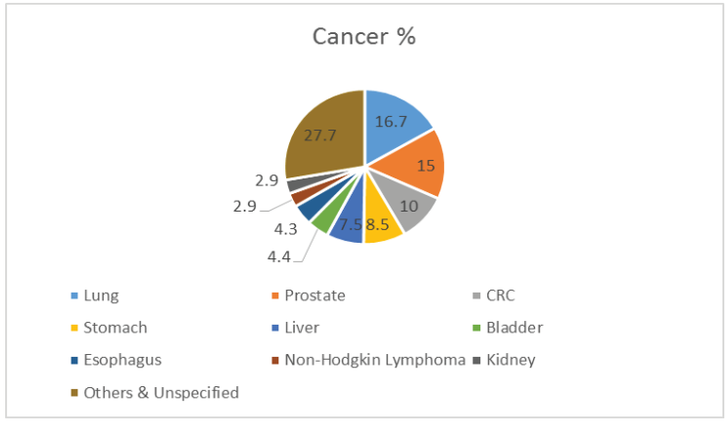
Table 1: Age standardized incidence rates of all and different cancers in Norway and other geographical regions according to GLOBOCAN 2012 (excluding non-melanoma skin cancer)

	All Cancers	**Lung**		**Breast**	**Prostate**	**Colorectal**		**Stomach**		**Cervical**	**Liver**	
		M	**F**	F	M	M	F	M	F		**M**	**F**
Globally	205.4	34.2	13.6	43.3	31.1	20.6	14.3	17.4	7.5	14.0	15.3	5.3
Country												
Norway	318.3	34.8	26.1	73.1	129.7	42.6	35.8	1.7	1.7	9.8	2.5	1.2
Europe												
Poland	205.8	**60.5**	21.8	51.9	35.9	32.3	19.5	5.1	2.9	12.2	3.4	2.0
Sweden	270.0	19.4	19.1	80.4	119.0	31.8	18.4	1.8	1.4	7.4	3.2	1.8
Lithuania	251.9	**55.4**	7.2	48.7	60.9	31.2	28.0	7.4	4.5	26.1	4.7	1.4
Denmark	338.1	41.6	37.6	105.0	91.3	45.9	35.7	2.4	1.1	10.6	4.5	1.4
Russia	204.3	51.4	6.8	45.6	30.1	30.0	21.8	10.1	6.8	15.3	4.4	1.9
Middle East												
Turkey	205.1	**63.9**	8.8	39.1	40.6	20.5	13.1	6.9	6.7	4.3	4.7	1.8
Iraq	135.3	24.2	6.6	42.5	8.7	7.9	6.4	4.3	3.1	2.8	4.9	3.7
Iran	127.7	10.3	5.0	28.1	12.6	11.6	10.5	14.8	9.7	2.8	2.8	2.1
South-East Asia												
Thailand	137.5	30.7	12.6	29.3	7.2	15.2	10.1	2.6	2.0	17.8	**34.8**	11.3
Vietnam	140.4	**42.1**	12.2	23.0	3.4	11.5	9.0	13.3	8.8	10.6	**40.1**	10.9
Philippines	140.0	31.3	9.5	47.0	18.0	11.1	7.3	3.3	1.8	16.0	17.1	6.5
South Asia												
Pakistan	111.8	9.8	1.7	50.3	5.3	4.7	3.3	3.8	1.7	7.9	4.7	2.5
India	94.0	11.0	3.1	25.8	3.7	4.3	3.5	9.1	3.7	27	3.2	1.2
Afghanistan	119.5	10.3	3.4	35.0	3.8	6.6	3.7	12.3	5.8	8.8	6.0	3.8
Srilanka	94.8	9.8	3.2	30.9	3.0	3.9	5.8	7.5	5.2	13.1	4.4	1.0
Africa												
Somalia	139.1	3.3	2.5	40.5	19.0	9.4	6.8	5.4	2.9	**33.4**	4.1	3.3
Morocco	117.8	25.5	2.8	40.8	14.3	9.9	7.3	4.2	2.6	18.5	1.2	1.1
Ethiopia	108.0	3.3	3.1	41.8	6.4	8.5	5.2	3.7	1.8	**26.4**	1.8	3.2

GLOBOCAN 2014 (http://globocan.iarc.fr

Figure 2a: Incidence of major cancers worldwide in (a) men and in (b) women

(a)



(b)

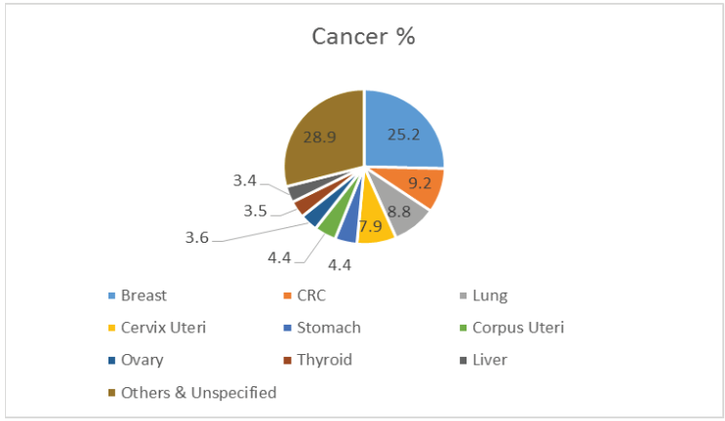
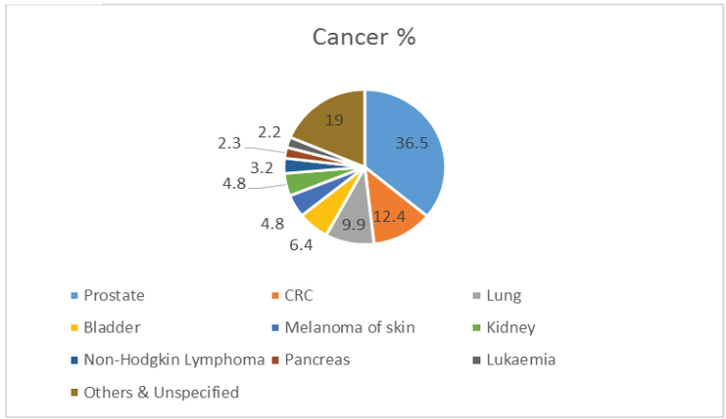
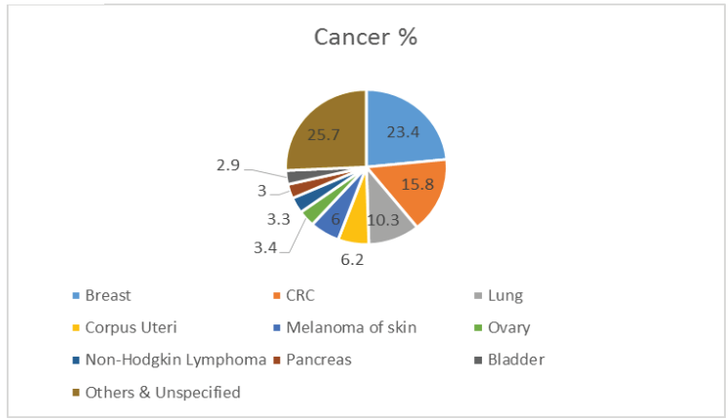


Figure 2a: Incidence of major cancers worldwide in (a) men and in (b) women

(a)



(b)



1.1.3 Cancer and Immigrants

Traditionally, there have been wide variations in cancer incidence rates internationally. However, larger differences are seen between the incidence rates at individual sites than those between the overall rates. This is because low income countries, with low incidence rates for most types of cancers, have a high risk regarding certain types of cancers. These include cervical, liver, stomach, and esophageal cancers [8]. Migration is further complicated by the fact that it is not necessarily a random process: those that leave may have either higher or lower levels of risk factors compared to those that remain. This "selection" of migrants may affect cancer risk, and thus the cancer rates in the migrating population may be different from that of the country of origin. However, this effect could disappear with time and in the second generation of immigrants.

Decades ago, cancer rates were substantially higher in Western countries than they were in East-Asia. For example, breast cancer incidence rates were at one point four to seven times higher in the US than in Japan. Cancer studies on immigrants in the US and Australia have shown that the incidence rate of common cancers start increasing the first decade after migration and reaches to the level of the population of the new host country in just one or two generations [9]. This has been interpreted as evidence of the role of lifestyle factors in cancer occurrence.

1.1.4 Cancer and immigrants in Norway

Although cancer represents a major public health problem in Norway, there is no systematic monitoring of cancer incidence, mortality, or attendance to screening among immigrants. This is because there is no system to record the country of birth and/or origin within the medical record of a cancer patient. The current Cancer Registry regulations do not provide a legal basis to register such information. This precludes a systematic determination of the magnitude of the burden of cancer among immigrants. There is an urgent need for data on the magnitude of the cancer problem among immigrant groups in Norway. Legislation should be changed so that the Cancer Registry can provide these data and to the researchers and policy-makers.

1.2 Aims

The main objective of this report is to summarize findings of the studies on cancer incidence in immigrants to Europe and North America, and studies of how migration affects the cancer incidence rates in different immigrant groups. We want to use this knowledge in understanding the potential challenges associated with cancer in immigrant groups in Norway.

2. Methodology

For this review report we searched the core database PubMed for the years 1990-2014 to identify published studies on the occurrence of cancer among migrants. We used non-specific search terms, such as: [Cancer] AND [English] AND [Immigr*]. We did not include the term [Ethnic] in our search. We limited our search to studies in the UK, USA, and Norway/Sweden. However, we did not find any relevant studies from Norway. In the search studies, immigrants relevant to the immigrant groups in Norway were the focus (Polish, Iraqi, Pakistani, Somalian, Iranian, and South-East Asians). The search results were imported into Endnote to store the citations and track the abstracts and articles for review.

Table 2: Key words, database, and number of hits during the search

Keywords	Database	Hits
[Cancer] AND [English] AND [Immigr*] AND [UK]	PubMed	48
[Cancer] AND [English] AND [Immigr*] AND [USA]	PubMed	835
[Cancer] AND [English] AND [Immigr*] AND [Sweden]	PubMed	95

As evident from the title, we further identified studies relevant to our topic or by reading the abstract. During the preliminary cleaning process, references were deleted due to duplicity, low relevance such as articles relating to mortality and survival, and immigrant groups not relevant to Norway (such as Hispanics, Filipinos, and Koreans). Most of the studies from the US were deleted for this reason. Additional studies were identified from the list of references of the articles derived from the databases. The Google search engine was also used to find additional publications. After the initial search, the search has been updated continuously until

March 2014, by cross-checking cited references and using an automatic alert system on the PubMed database.

From the above-mentioned hits, we selected a subset of studies based on the following inclusion criteria: Peer-reviewed journal articles or reviews published in English, particularly those focused on incidence addressing common cancers, and specifically those defined as migrant or immigrant group. The studies selected in this review include 15 from USA and Canada, eight from the UK, 13 from Sweden and two each from Germany, Denmark and the Netherlands, as well as one from France.

The majority of the studies used cancer registries and surveillance systems as their data sources. Almost all the articles concentrated on international migration, with the majority of studies focusing on Asian migrants. Data and information extraction and synthesis from the literature was done using a form that consisted of authors, title, year of publication, main outcome of study, study and participant characteristics, main findings, conclusions, recommendations, and study limitations. These are presented in *Appendix I* [10]. The methodological features and findings from studies done on incidence of cancer among immigrants in Europe are presented in *Appendix II,* whereas for USA and Canada, the methodological features and findings from studies done on incidence of cancer among immigrants are presented in *Appendix III*.

3. Results and Main Findings

Most of the studies reviewed were of immigrants from Asia to Europe or USA/Canada. These studies conclude that there is definitely a change in the rates of cancer among immigrants. Overall, the rates of all types of cancers combined are lower among the immigrants than among the host population.

Table 3 gives a summary of differences in cancer rates and describes what the various articles cover on suggested risk factors that may explain the differences in cancer incidence among immigrants.

3.1 Immigration and Cancer Incidence

The differences in incidence rates of cancer among immigrant groups as evident from the studies can be summarized under the following subheadings:

Differences compared to host population

In general, the findings from the studies among immigrants done in the UK [11-14], Sweden [15-21], USA [22], and Canada [23] indicate that the first-generation non-Western immigrants have a lower incidence of cancer as compared to the host population. This is true particularly for cancers such as breast [24] and colorectal [17], which are related to lifestyle - i.e., reproductive factors, energy-dense diets, physical inactivity, and obesity [25]. However, the cancers related to infectious agents such as liver, gastric, esophageal, oral, and cervical are more common among immigrant groups than among the host population [25].

Differences between immigrant populations

The well-known geographical variation in cancer rates can also be seen among immigrants. There are substantial differences in rates of the cancers of the gastrointestinal tract between immigrant groups from South Asia, Black Africans, and Black Caribbeans [12, 13]. South Asian countries, for example, have some of the lowest rates of colorectal cancer globally. Additionally, there are differences in incidence between Indians, Pakistanis, and Bangladeshis regarding cancers of the esophagus, stomach, liver, and gallbladder [12].

Age at Migration

Age at time of migration as well as number of years lived in the new country has been associated with cancer rates among immigrants [26]. After five decades of residence in Sweden, an increase in colorectal cancer rate was observed among Asian immigrant men (Turkey, Asian-Arab countries, and South Asian countries) who were < 30 years at the time of migration [26]. However, there were no changes in the risk trends among immigrants who immigrated at an older age (≥ 30 years). Similarly, years lived in the US as well as age at immigration was associated with higher breast cancer rates in Asian immigrants to California [27]. Likewise, women migrating from high risk areas of colorectal cancer to Sweden showed a decrease in risk if they immigrated at < 30 years of age [26]. Prostate cancer did not show any association with age at migration [26].

Lifestyle factors

Cancers such as lung, breast, and colorectal cancer are linked to lifestyle factors. As the lifestyle changes, the incidence of these cancers also starts to increase. Some factors start to play a role during childhood and puberty, and their effects continue in adult life. However, some factors such as smoking, diet, and obesity are modifiable, and changing these can affect cancer risk.

There are few data on lifestyle factors among immigrants in Norway. However, a study on immigrant groups in Oslo reported the presence of high smoking estimates among some groups [28]. Turkish men had the highest smoking estimates (56%), followed by Iranians (42%) and Vietnamese (36%) as compared to Norwegian men (27%) [28]. The high smoking rate among Turkish men is worth noting, as this group may start to develop smoking-related cancer at high rates in a few years.

Table 3: References to studies describing cancer rates and factors that may explain differences in cancer rates between immigrants and the new host population

		Cancer rates				Factors playing a role					
		Lower rates in migrants		Higher rates in immigrants		Age at migration		Lifestyle		Earlier infections	
Migrant origin	**Cancer types**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Europe and Turkey	**All**	[21, 24, 29]	[24]					[21]		[30]	
	Esophageal	[29]	[29]								
	Gastric			[24, 29]	[21, 29]			[29]	[29]	[29]	[29]
	Liver			[18, 29]	[29]			[29]	[29]	[29]	[29]
	Gall bladder			[29]	[29]			[29]	[29]	[29]	[29]
	colorectal cancer	[26, 29]	[26, 29]	[24]			[21]				
	Lung	[26, 31]	[29, 31]	[21, 29]		[31]					
	Breast		[24, 29, 31, 32]		[21]		[32]				
	Cervical		[31]		[29]						
	Prostate	[15, 29]		[11, 21]				[15]		[21]	
Middle East	**All**	[15, 25]	[15, 25]					[21]		[11]	
	Esophageal										
	Gastric			[25]	[25]			[25]	[25]	[25]	[25]
	Liver	[18]	[18]	[25]	[21]			[25]	[25]	[25]	[25]
	Gall bladder		[18]								
	colorectal			[29]		[29]					
	Lung										
	Breast		[26, 32]				[26, 32]		[25]		
	Cervical				[25]						[25]
	Prostate	[15]									

Table 3 continued

South East Asia	**All**	[29]	[25]								
	Esophageal	[29]	[29]								
	Gastric	[29]	[29]								
	Liver			[18, 29]	[18, 29]			[29]	[29]	[29]	[29]
	Gall bladder			[29]	[18, 29]			[29]	[29]	[29]	[29]
	colorectal	[29]	[29]	[29]		[29]					
	Lung	[29]	[29]								
	Breast		[26, 29]				[26]		[25]		
	Cervical				[29]						
	Prostate	[15]									
South Asia	**All**	[25, 29]	[25, 29]								
	Esophageal	[12]	[12]	[29]	[29]			[12]	[12]		
	Gastric	[12]	[12]	[29]	[29]			[12]	[12]		
	Liver			[12, 18, 29]	[18, 29]			[12]	[12]		
	Gall bladder	[12, 18]	[12]	[29]	[29]			[12]	[12]		
	colorectal	[11, 12]	[12]			[21]		[12]	[12]		
	Lung	[11]									
	Breast		[25, 26, 29]		[26]		[26]		[25]		
	Cervical										
	Prostate	[15, 25, 29, 30]						[25]			
Africa	**All**	[21, 25, 29]	[25]					[21]		[21]	
	Esophageal	[12]	[12]		[13]			[12]	[12]		
	Gastric	[12, 29]	[15, 29]	[25]	[25]			[12, 29]	[12, 29]	[12, 29]	[12, 29]
	Liver	[12]	[12]	[18, 25, 29]	[18, 25, 29]			[12, 29]	[29, 32]	[29, 32]	[29, 32]
	Gall bladder	[11, 18]	[12]	[29]	[18, 29]			[12, 29]	[29, 32]	[29, 32]	[29, 32]
	Colorectal	[12, 25, 29]	[12, 25, 29]	[21]				[12]	[12]		
	Lung	[29]	[29]								
	Breast		[25, 26, 29, 32]		[21, 29]		[26, 32]				
	Cervical				[25]						[25]
	Prostate	[25]						[25]			

3.2 Specific Cancers

In the following section we give a summary of specific cancers from the reviewed studies. *Table 4* gives an overview of new cases of specific cancers globally and in Norway for 2012.

Table 4: Number of new cases of specific cancers in the world and in Norway in 2012

Cancer	World	Norway
Lung	1,800,000	2,902
Breast	1,700,000	2,984
Colorectal	1,400,000	4,021
Prostate	1,100,000	4,919
Stomach	952,000	470
Cervix	529,800	330
Liver	782,451	215

Lung Cancer

Lung cancer is the most commonly diagnosed cancer worldwide [6]. It is the leading cause of cancer deaths in both high and low income countries [33]. Recent trends in lung cancer reflect a smoking epidemic. The majority of cases (75%) are diagnosed at an advanced stage [66]. Tobacco smoking is the single most common cause of lung cancer [34].

Lung cancer rates among immigrants are determined by the smoking habits among the immigrant population. This provides an opportunity for targeted intervention. Asian immigrants to the US experienced higher rates of lung cancer as compared to the non-Hispanics Whites [22]. This is probably due to higher smoking rates among the Asian immigrants.

Previous studies have shown a lower incidence of lung cancer (20-30%) among immigrants than that of the population in the country of origin [35, 36]. A study in Sweden showed a 50% lower rate of lung cancer among Turkish immigrants as compared to Turkish men in Izmir,

Turkey [21]. On the other hand, the cancer rate among Turkish immigrant women was higher than that of the women in Izmir and Antalya. This may be an indication of change in the prevalence of smoking in the group that emigrates, but it could also suggest cultural acculturation (change in smoking habits) after migration [37]. Swedish men may smoke less than Turkish immigrants, though Swedish women have been reported to smoke as much as men [38].

An increase or a decrease in the prevalence of tobacco consumption in a population is evident some two to three decades later by an increase or a decrease in the incidence of lung cancer. Therefore, it is important to implement interventions for the immigrant groups in question because the incidence pattern of lung cancer is consistent with the population prevalence of smoking in the past decades.

Breast cancer

Breast cancer is the second most common cancer in the world and the most frequent cancer in women. Worldwide breast cancer incidence has increased by more than 20%, while mortality has increased by 14 %, since the 2008 estimates [6]. Breast cancer is also the most frequently diagnosed neoplasm among women in Norway [7]. It represented more than 20% of all female cancer cases in 2012.

Female sex steroids play a crucial role in the etiology of breast cancer and are connected to many established risk factors for breast cancer. Early age at menarche, late age at first birth, nulliparity, late and type of menopause [39-42], postmenopausal body weight [43, 44], physical inactivity [42, 45, 46], alcohol [41, 43, 44], postmenopausal hormone therapy [47-52], and lack of breast feeding [39, 41] are established breast cancer risk factors.

Migrant studies on breast cancer have shown that the rates increase when migrants move from a low-risk to a high-risk country. The rates ultimately approach the rates among the population in the new country during the first or second generation [11, 36, 53-56]. This long time frame thus provides the potential for encouraging healthy lifestyle choices that may reduce the risk of breast cancer, such as: weight control, physical activity, and limiting alcohol intake. Studies done in Sweden among immigrant women from Turkey, North Africa, Chile, Iran, and some Arab countries, not only showed an increase in risk of breast cancer post-migration, but also an earlier mean age at diagnosis than among Swedish women [21, 32]. These women had an average age of 45 years as compared to 50 years for native Swedish women (who, along with their parents, were born in Sweden) [32]. This could suggest that the

screening program which starts at age 50 is not optimal for some immigrant women. More research is therefore needed on what is the optimal age for starting screening in these women.

Prostate cancer

Prostate cancer is the second most common cancer diagnosed and the fifth most common cause of cancer death among men worldwide [57]. Prostate cancer is the most frequent cancer in men aged over 50. Prostate cancer incidence rates are high in the US, Australia, New Zealand, and Canada, and low in Asia (India, China, Japan, and Singapore) [57]. The incidence of prostate cancer in Norway has been increasing just as it is in other high income countries. This may be attributable to the increased use of the prostate specific antigen (PSA) screening [58].

The only established risk factors for prostate cancer are age, race, and a family history of prostate cancer. Genetic factors account for a possible substantial proportion of these types of cancers. The strongest non-genetic factor is probably screening with PSA.

In a study done in Sweden on immigrant groups, their rates were statistically significantly lower as compared to the Swedish-born men [17]. However, several studies of prostate cancer have found that incidence rates in migrants are between those of the country of origin and that of the majority population in the new country of residence [59, 60]. Migrants to Australia from some countries in Asia (China or Taiwan, India or Sri Lanka, Vietnam) had prostate cancer incidence rates between those of their original countries and the Australian-born population. At the same time, migrants from other countries (Hong Kong, Indonesia, Malaysia, Singapore, or the Philippines) had rates similar to that of Australians [61].

Men of African descent have been found to have an increased risk of advanced prostate cancer. Data from the US have also shown differences between white American and African American men. African American men have the highest rate of prostate cancer in the world - 1.6 times higher than that of white American men. Immigrants from areas with high rates of prostate cancer are thus likely to be at a higher risk even after migration. It is thus important that the physicians are aware of this potential high risk of advanced prostate cancer in some immigrant groups.

Colorectal cancer

Colorectal cancer is the third most common cancer in men worldwide. It is the second most common cancer diagnosed in both sexes in Norway. Dietary composition, obesity, and lack of physical activity contribute to the risk of colorectal cancer [44].

Previous studies on colorectal cancer among non-Western immigrants have shown a lower rate as compared to their counterparts in the US/ Europe [14, 29]. However, a number of studies have shown an increase in risk among the immigrant population after migration, similar to that in the new host country [11, 14, 21]. Thus it is important to encourage lifestyle habits that may prevent development of this cancer in new immigrants.

Stomach (gastric) cancer

There is a wide geographical variation in the distribution of gastric cancer. It is the fifth most common malignancy in the world, after cancers of the lung, breast, colorectal, and prostate. Stomach cancers are classified according to the tissues from which they originate, and the majority of them are adenocarcinomas arising from the glandular tissues. Infection with *H.pylori* is the most frequent cause [62]. In addition, lifestyle factors such as smoking, drinking alcohol, and eating a diet low in fruits and vegetables or a diet high in salted and/or smoked foods, may increase the risk.

Studies on gastric cancer among immigrants have not shown a uniform pattern, but reflect variations in *H.pylori* infection across the world. Gastric cancer is less common in the United States and other European countries than in countries in Asia and South America. First generation Japanese who have immigrated to the US had rates of carcinoma more than six times than that of the white US-born Americans, but half the rate of their native counterparts back home, and even lower in the subsequent generations [35]. However, Chinese males immigrating to the United States were reported to have a rate similar to that of white Americans, whereas the rate among female Chinese immigrants was twice that of white American women [35].

A study done in Sweden showed lower stomach cancer rates in the immigrant groups (Turks, Chileans, and North Africans) as compared with native Swedes [21]. Another study done among foreign-born Arab Americans showed a higher incidence of stomach cancer among this group as compared to US-born white Americans and US-born Arabs [63]. It may be that changes in lifestyle upon migration along with other environmental factors might be responsible. Given that stomach cancer is now rare in Norway, symptoms of this disease may be overlooked or interpreted as being something else. It is thus important that Norwegian physicians are aware of this risk among some immigrant groups.

Cervical cancer

Cervical cancer is the fourth most commonly diagnosed cancer and the fourth leading cause of cancer death in females worldwide [64]. More than 85% of the global burden occurs in low income countries, where it accounts for 13% of all female cancers. In Eastern Africa and South-Central Asia it represents the most common cancer in women [65].

The primary cause of cervical cancer is a persistent infection of the genital tract by a high-risk human papillomavirus (HPV) type. Genital HPV infections are very common and acquired soon after the onset of sexual activity. Most of these infections are spontaneously cleared. However, persistent HPV infections with a high-risk HPV type can cause cellular changes in the cervix that can result in cervical cancer. Cervical cancer can be prevented by HPV vaccination or by screening and treatment of carcinoma *in situ* [66].

A lower incidence of cervical cancer predominantly among Asian and Middle Eastern immigrants was reported when compared to the new host population [17, 29, 67]. However, immigrants from East Africa and South-East Asia may be at a higher risk due to increased cervical infections and no cervical screening in these countries. Therefore, the immigrant women should follow the screening guidelines in the new host country. Though it is important to encourage all women to follow the Norwegian screening guidelines, it especially the case for women from the above-mentioned countries to do so as soon as they arrive.

Liver cancer

The incidence rates for liver cancer vary globally depending on the distribution of: chronic infection by hepatitis B or C virus (HBV and HCV), alcohol-induced liver cirrhosis, metabolic syndrome (non-alcoholic fatty liver disease), and tobacco smoking [18, 68]. Norway has a low incidence rate of liver cancer [57].

Globally, Northern Europe and North America belong to low-risk areas while South-East Asia and Africa are considered as high-risk. A study in Sweden reported higher rates of primary liver cancer in many first generation immigrants. The risk was highest for immigrants from the East and Southeast Asian and African countries [18]. Another study from the UK reported strong differences in risk for liver cancer among different immigrant groups [12].

4. Challenges for Norway

Some types of cancers are higher among specific immigrant groups, and these warrant our attention. Examples are stomach cancer, liver cancer, and cervical cancer. Prostate cancer rates may be higher among some African men, and breast cancer may occur at a younger age in women from some of the immigrant groups in this study.

4.1 Lifestyle factors

Many immigrant groups come from countries where lifestyle factors associated with cancer are less prevalent when compared to Norway. Previous studies suggest that changes in lifestyle take place after migration occurs. This means that there is a window of opportunity for intervening, i.e., to modify lifestyle changes, such as curbing obesity, maintaining a healthy weight, staying physically active, and minimizing alcohol intake. If such interventions are implemented successfully, this could counteract the increased rates of lifestyle associated cancers in the future.

There are also some risk factors that are more prevalent within some specific immigrant groups. One example of this is smoking. Studies done on Polish immigrants in the UK have reported a high incidence of drinking and smoking among this group [69]. In a survey carried out in Dublin in 2007, it was reported that Poles had a two-fold increased smoking rate as compared to the general Irish population [69]. Men had higher smoking estimates (50.9%) than women (39.8%). Furthermore, according to another study there were much higher rates of drinking and smoking among young Polish single men in Watford. It is evident from these studies that the prevalence of smoking and drinking among Polish immigrants in Norway should be expected to be high as well. These studies show important implications for both prevention and interventions to combat these behaviors. Similarly, the high prevalence of smoking among Turkish (56%) and Iranian (42%) as compared to Norwegian men (27%) is alarming. This highlights the importance of addressing smoking behavior among these groups to possibly lower the risk of lung cancer in future.

4.2 Lack of awareness

Public awareness that cervical cancer can be prevented and breast cancer outcomes can be improved through early detection is critical to improve immigrants´ participation in early

detection programs. Cultural differences and the stigmas attached to breast cancer inhibit women from disclosing the disease even to their immediate family members. Asian immigrant women, especially those of Pakistani origin, abstain from discussing the topic breast cancer due to the sensitivity attached to it [70]. According to a study in the UK, the majority of a group of immigrant women from South Asia were completely unfamiliar of the term cancer; they expressed lack of knowledge about cancer as a disease and its symptoms.

4.3 Screening

Insufficient knowledge about cancer screening programs in the host country is an important reason for low participation among immigrant women. There are several reasons why this task is challenging to implement among immigrant populations. The immigrant women may not have been educated about cervical and breast cancer risks, or may have major misconceptions about the nature or curability of the disease. It may be uncomfortable for them to discuss cervical or breast health with healthcare providers, or they may have religious or traditional customs that need to be recognized and accommodated in order to fully participate in breast or cervical cancer screening programs. Inability to communicate with the health staff due to language barriers has also been identified to be a reason for not participating in the screening program.

5. Conclusions

The incidence of cancer among immigrants in Norway is currently unknown. Therefore, it is important that the Norwegian health authorities alter legislation to make data on cancer occurrence readily available so that changes can be monitored. It is also important to provide funding to support research that will enable us in the future to face these cancer challenges among the immigrant population.

The specific groups and the specific exposures and types of cancers among these groups that should be targeted are:

- High prevalence of smoking and ultimately lung cancer among specific immigrant groups
- Early onset breast cancer among immigrant women from certain Middle Eastern and certain African countries
- Prostate cancer among immigrants from certain African countries
- Norwegian physicians should be aware of the high rates of cervical, gastric, and liver cancer among immigrants from the middle eastern and northern parts of Africa, as well as immigrant groups from South and South-East Asia
- Immigrant groups should be encouraged to start following the Norwegian screening guidelines as soon as they arrive

The fact that several lifestyle related cancers occur at a lower rate among immigrant groups gives us the potential for preventing these cancers in these groups. However, in order to do so there is a strong need for lifestyle changes and preventive measures to avoid the incidence rates from converging towards that of the new host population.

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Appendix I – Data/study findings extraction form

Author
Title
Ref. ID and Reference
Cancer Type
Study period
Study characteristics: • Aim/objective of study • Study design • Sample population and size • Data analysis methods
Participant characteristics : • Age • Gender • Ethnicity • Migration category
Main findings: With regard to age, gender, ethnicity, migration category, etc.
Conclusion and recommendation

Appendix II

Methodological features and findings of studies done on Cancer among immigrants in UK, Sweden, Germany, and Netherlands 1999-2013

Author/ Year of Pub.	**Country**	**Immigrant population**	**Sample size (N)**	**Years of data**	**Reference population**	**Cancer type**	**Risk measure (adjustments)**	**Differences in cancer rates or risk factors/comments**	**Explanatory variables**
Loeb, S., et al., 2013 [15]	Sweden	- Middle Eastern - Southern European - Asian	8,332	1991-2008	Native Swedish men	Prostate	OR (SES, education, marital status)	- Low risk lower among first-generation immigrants	- Environmental factors - Lifestyle factors
Mousavi, S.M., et al., 2013 [21]	Sweden	First-generation immigrants: - Turkish - Chilean - North African		1998-2002	- Residents in their countries of origin - Native Swedish	All	ASR	Increased rates of: - Colon cancer - Breast cancer - Nervous system cancer	- Lifestyle factors - Early childhood exposures
Ali, R., et al., 2013 [12]	UK	- Indian - Pakistani - Bangladeshi - Black African - Black Caribbean - Chinese	378,511	2001-2007	- Native Whites	- Esophageal (colorectal) - Gastric - Liver - Gall bladder	Incidence rate ratios (adjusted for age, sex and income)	- The risk of GI cancer varies by individual ethnic group	- Patterns of behavior

Appendix II continued

Author/ Year of Pub.	Country	Immigrant population	Sample size (N)	Years of data	Reference population	Cancer type	Risk measure (adjustments)	Differences in cancer rates or risk factors/comments	Explanatory variables
Maringe, C., et al., 2013 [11]	UK	South Asian (includes Indian, Pakistani, and Bangladeshi)	31,187	1986-2004	Non-South Asian	- Colorectal - Lung - Breast - Prostate	Incidence rates (SES, deprivation, age)	Cancer incidence is rising in: - South Asians Supporting the concept of: - Transition in cancer incidence	- Unknown risk factors
Mousavi, S.M., et al., 2012 [26]	Sweden	Mixed		1958-2008	Native Swedish	- Colorectal - Lung - Breast - Prostate	SIR	Study points out: - A role of age at immigration on the risk trend of cancer	- Age at migration - Duration of stay
Coupland, V.H., et al., 2012 [13]	UK	- Indian - Pakistani - Bangladeshi - Black Caribbean - Black African - Chinese	76,130	2001-2007	Native Whites	- Esophageal - Gastric	Age-standardized incidence rate ratios (ASIR)	Substantial ethnic differences in incidence of: - Esophageal cancer - Gastric cancer	- SES - Chewing tobacco

Appendix II continued

Author/ Year of Pub.	Country	Immigrant population	Sample size (N)	Years of data	Reference population	Cancer type	Risk measure (adjustments)	Differences in cancer rates or risk factors/comments	Explanatory variables
Hebbar, S., et al., 2012 [14]	UK	South Asian	42 cases	1989-2008	Non-South Asian Whites	- Colorectal	IRRs	There was an equal increased trend in both: - South Asians - Non-South Asians	- Diet
Hemminki, K.., et al., 2011 [32]	Sweden	- Turkish - Iranian - African	0.6 million	1958-2006	Swedish women	- Breast	SIR	Women from nine regions showed: - Earlier mean age at diagnosis	- Biological factors
Hemminki, K.., et al., 2011 [71]	Sweden	- Turkish - Iraqi - Iranian - Asian - Arabic - South Asian - Southeast Asian - East Asian	11,277	1958-2006	Native Swedish women	- Breast	SIR	Immigrants from low risk areas to Sweden show: - Age-specific incidence patterns - Similar to Swedes half a century ago	- Biological factors - Lifestyle factors

Appendix II continued

Author/ Year of Pub.	Country	Immigrant population	Sample size (N)	Years of data	Reference population	Cancer type	Risk measure (adjustments)	Differences in cancer rates or risk factors/comments	Explanatory variables
Hemminki, K., et al., 2010 [18]	Sweden	- East African - Iraqi - Iranian - Indian - Southern European - Turkey	1,428	1958-2006	Native Swedish	- Liver - Gallbladder	SIR	- Primary liver cancer was increased in immigrants - Especially from endemic regions of Hepatitis B-virus	- Pre-migration infections
Arnold, M., et al., 2010 [25]	EU-countries	Non-Western immigrants		1990-2010	European natives	All		- Migrants from non-Western countries develop cancers that are related to infectious diseases	- Environmental factors - Lifestyle factors

Appendix II continued

Author/ Year of Pub.	Country	Immigrant population	Sample size (N)	Years of data	Reference population	Cancer type	Risk measure (adjustments)	Differences in cancer rates or risk factors/comments	Explanatory variables
Spallek, J., et al., 2009 [31]	Germany	- Turkish	1,346 cancer cases	1990-2004	- Representative population sample of Hamburg	- Digestive - Urinary tract - Prostate	Incidence RR (year of birth)	- Early life experiences and infections (e.g. HPV and EBV) - Different nutritional patterns (cancer of digestive, urinary tract, and prostate) - Higher smoking prevalence among Turkish males - Different reproductive behavior	
Metcalfe, C., et al., 2008 [30]	UK	South- Asian	88	2001-2003	Native Whites	- Prostate	Incidence rates	- Lower prostate cancer rates in South Asian men	
Norredam, M., et al., 2007 [72]	Denmark	Migrants from East Europe, the Middle East, and North Africa	(1st generation migrants) (N) = 62461: - Controls (Danish-born): 249,899 - Cancer cases: (N) = 3366 migrants	1993-2003	Native Danish	- Breast - Colorectal	Incidence RR (age, region of origin, migrant type, duration of residence)	- Decline in incidence in migrant women - Related to increased cancer diagnostic activities such as screening and better access to healthcare services	- Lifestyle patterns (breast and colorectal cancer) - Smoking

Appendix II continued

Author/ Year of Pub.	Country	Immigrant population	Sample size (N)	Years of data	Reference population	Cancer type	Risk measure (adjustments)	Differences in cancer rates or risk factors/comments	Explanatory variables
Visser, O. and F.E. van Leeuwen, 2007 [29]	The Netherlands	Western: - German - British - Belgian Non-Western: - Turkish - Chinese - Moroccan - Sub-Saharan African	9,271	1995-2004	Native Dutch	All	SIR	- Low cancer risk - Relatively high risk for cancer related to infectious disease	- SES - Lifestyle factors
Visser, O., et al., 2004 [73]	The Netherlands	- Turkish - Moroccan - Surinamese	1,699	1989-1998	- Native Dutch	Breast	SIR	- Low-risk for women > 50 - Slightly high-risk for women < 50 - Change in risk factors such as lower parity	- SES - Lifestyle factors

Appendix II continued

Author/ Year of Pub.	Country	Immigrant population	Sample size (N)	Years of data	Reference population	Cancer type	Risk measure (adjustments)	Differences in cancer rates or risk factors/comments	Explanatory variables
McCormack, V., et al., 2004 [54]	UK	First generation South Asian in following subgroups: - Gujarati Hindu - Punjabi Hindu - Punjabi Sikh - Pakistani and Indian Muslim - Bangladeshi Muslim - Other	240		First generation Gujarati Hindu in UK	- Breast	OR (SES, family history, body size, diet, RF)	- Risk heterogeneity - Increased risk for Muslim women despite protective RF - No association with age at migration	- SES - Body size - Diet
Zeeb, H., 2002 [24]	Germany	- Turkish	144	2001-2007	- Native German	- Lung - Breast	PCIR	- Transition in cancer incidence from low to high	
Warnakula-suriya, K., et al., 1999 [74]	UK	- South Asian - Chinese	7,521	1986-1991	- Native Whites	- Oral - Pharyn-geal	Incidence rates	- South Asian and Chinese ethnic minorities constitute important high risk groups for oral and nasopharyngeal cancer - Targeted prevention is indicated	- Tobacco chewing

Appendix II continued

Author/ Year of Pub.	Country	Immigrant population	Sample size (N)	Years of data	Reference population	Cancer type	Risk measure (adjustments)	Differences in cancer rates or risk factors/comments	Explanatory variables
Harding, S., et al., 1999 [75]	UK	- Scottish - Irish - West Indian - South Asian	- Scottish: 6,502 - Irish: 7,679 - West Indian: 2,119 - South-Asian: 3,362	1971-1989	Native Whites in England	All	SIR	- Breast cancer was the most common malignancy among females - Lung cancer among males	- Environmental factors - Screening
Bouch-ardy, C., et al., 1994 [76]	France	- Chinese - Southeast Asian		1979-1985	Metropolitan-born population in France	-Naso-pharyngeal - Liver	Mortality RR (age, social class, area of residence)	- Consumption of salted and preserved foods (nasopharyngeal cancer) - Early childhood exposures - Genetic susceptibility High and early exposure to infection with hepatitis B-virus and aflatoxin, chronic - Infection with liver flukes (liver cancer)	- Earlier hepatitis B-infections (liver cancer)

Appendix III

Methodological features and findings of studies done on Cancer among immigrants in USA/ Canada 1993-2014

Authors/ Year of Pub.	Country	Immigrant Population	Sample size (N)	Year of data	Reference Population	Cancer type	Risk measure (adjustment)	Differences in cancer rates or risk factors/comments	Explanatory variables
Gomez, S.L., et al., 2013 [59]	USA	- Indian - Pakistani - Chinese - Filipino - Japanese - Kampuchean - Korean - Laotian - Vietnamese		1990-2008	Non-Hispanic Whites	- Breast - Lung - Liver - Colorectal - Cervical - Stomach	IR & APC	- Increased preventive screening - Surveillance efforts are needed	- Lifestyle factors - Acculturation
McDermott, S.et al., 2011 [23]	Canada	- South-East Asian - North-East Asian		1980-1998	Canadian	All and specific: - Liver - Colorectal - Cervical	SIR (gender, refugee status)	- Incidence of all-site cancer was lower among immigrants	- Pre-migration viral infections in host country
Chen, Y., et al., 2008 [77]	Canada	- Asian - African	1,877	1998-2002	Canadian Whites	- Liver	SIR	- Immigration is an important reason for the clustering of liver cancer in Ontario	- Immigration

Appendix III continued

Authors/ Year of Pub.	Country	Immigrant Population	Sample size (N)	Year of data	Reference Population	Cancer type	Risk measure (adjustment)	Differences in cancer rates or risk factors/comments	Explanatory variables
McCracken, M., et al., 2007 [55]	USA	Asian Americans of Chinese, Filipino, Vietnamese, Korean, and Japanese ethnicities				- Prostate - Breast - Lung - Colon/rectum - Stomach - Liver - Cervix	AAIR	- Differences in cancer burden among Asian-American ethnic groups.	- Immigration - Behavioral factors - Linguistic barriers
Andreeva, V.A., Unger, J.B., and Pentz, M.A., 2007 [53]		16 countries	79 studies	1971-2005		- Breast	Incidence	- Important modifiable environmental and behavioral determinants of risk - Both pre- and post-migration	

Appendix III continued

Authors/ Year of Pub.	Country	Immigrant Population	Sample size (N)	Year of data	Reference Population	Cancer type	Risk measure (adjustment)	Differences in cancer rates or risk factors/comments	Explanatory variables
Lee, J., et al., 2007 [60]	USA	- South Korean					Incidence	- Risk of cancers common in Western countries is higher for Korean Americans	- SIR
Yavari, P., et al., 2006 [56]	Canada	- Iranian			- General population of British Columbia, Canada	- Breast - Colorectal	SIR	- Incidence of breast cancer was increased four-fold - Colorectal cancer two-fold, as compared to Iranian rates	- Lifestyle factors
Luo,W., et al., 2004 [36]	Canada	- Chinese		1974-1993	- Indigenous Chinese Canada born	- All sites	AAIR, SIR	- The risk of cancer in immigrants tends towards the risk of people in the new host country	- Physical activity - Diet
Deapen, D., et al., 2002 [78]	USA	Asian	2,889		- Population of LA county	- Breast	AAIR	- Increased rates for most ethnicities	- Exposures after migration (RF, body size, diet)
Flood, D., et al., 2000 [79]	USA	- Japanese - Chinese - Filipino	- Japanese: 2,347 - Chinese: 1,185 - Filipinos: 857	1973-1986	- US-born whites	- Colorectal	RR (age, sex)	- One or more exposures or characteristics that differ between Japanese migrants and their descendants affect the development of colorectal cancer	- Diet

Appendix III continued

Author/ Year of Pub.	Country	Immigrant Population	Sample size (N)	Year of data	Reference Population	Cancer type	Risk measure (adjustment)	Differences in cancer rates or risk factors	Explanatory variables
Blesch, K., 1999 [80]	USA	Asian	75	1988-1991	- Indigenous Indian - US Whites	- Breast - Colorectal	AAIR	- No association between diet breast cancer and colon cancer in Native Indians	- Exposures after migration (diet)
Kamineni, A., et al., 1999 [35]	USA	- Japanese - Chinese - Filipino	- Japanese: 1,183 - Chinese: 303 - Filipinos: 197	1973-1986	- US Whites	- Gastric	RR	- Incidence 3-6 times higher in Japanese-Americans than US Whites - Chinese women have 2-3 times increased incidence than US White women	- Diet - Lifestyle factors
Herrington, L.J., 1994 [81]	USA	- Chinese - Japanese - Filipino	Asians: 467	1973-1986	- US Whites	- Ovarian	RR	- Lower incidence of ovarian cancer - Protective factors, genetic or otherwise	- Genetic factors
Ziegler, R., 1993 [27]	USA	- Chinese - Japanese - Filipino	597		Population-based ethnicity: age and study area-matched controls	- Breast	OR (age, study area)	- Increase in incidence of breast cancer risk in Asian migrants	- Age at migration - Duration of residence - Lifestyle factors
Ross, R.K., et al., 1991 [48]	USA	- Vietnamese	45	1972-1988	Chinese immigrants in LA	- Breast	AAIR	- Lower breast cancer rates in Vietnamese as compared to Chinese immigrants	- Exposure after migration