

## ***Title and author list***

### **Title:**

Cohort Profile: Understanding socioeconomic inequalities in health and health behaviours -  
The GLOBE study

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## **Summary**

The main aim of the GLOBE study is to quantitatively assess mechanisms and factors explaining socioeconomic inequalities in health in the Netherlands. Baseline data was collected by postal survey in 1991 among 18,973 respondents aged between 15 and 75 years from the city of Eindhoven and its surrounding municipalities. Subsamples (total n=5,667) were interviewed and/or surveyed in 1991, 1997, 2004 (also including a new sample) and most recently in 2011. Information was asked on indicators of socio-economic position, a range of potential explanatory factors (material, behavioural, psychosocial and environmental) and health outcomes. From 2004 onwards, special emphasis was given to the identification of physical, social and cultural environmental factors in the explanation of socioeconomic inequalities in health behaviours. Information from the baseline postal survey onwards can and has been linked to several registries of causes of death, hospital admissions and cancer. Researchers are cordially invited to contact the project leader ([f.vanlenthe@erasmusmc.nl](mailto:f.vanlenthe@erasmusmc.nl)) to propose research based on the data.

## ***Key messages***

- The GLOBE study found evidence of socioeconomic inequalities in mortality, self-assessed health, hospital-based incidence of several diseases, cancer incidence, and self-reported chronic diseases.
- Multilevel studies demonstrated that residing in socioeconomically disadvantaged neighbourhoods was related to mortality, self-assessed health, overweight and obesity, smoking, and physical inactivity after taking into account the composition in terms of individual level socio-economic position.
- The GLOBE study found evidence for a role of environmental, material, behavioural and psychosocial factors in the explanation of these inequalities in health and health behaviours.
- The most recent wave of data-collection aimed to increase understanding of socioeconomic inequalities in (un)healthy food choices, with an emphasis on the role of cultural capital.

## ***Why was the cohort set up?***

The publication of the Black Report<sup>1</sup> in the UK on socioeconomic inequalities in health inspired Dutch researchers and policymakers to summarize existing evidence of such inequalities in the Netherlands. The results of this endeavour demonstrated socioeconomic inequalities in the prevalence of self-reported chronic conditions, self-assessed health and mortality, but also showed major gaps in knowledge about the magnitude of socioeconomic inequalities for a substantial number of other health outcomes.<sup>2</sup> The former Dutch Ministry of Welfare, Public Health and Cultural Affairs subsequently launched a five-year research programme in 1989. As part of this programme, research was initiated aimed at describing the association between socioeconomic position (SEP) and health indicators, and perhaps even more important, at improving the understanding of the underlying causes of socioeconomic inequalities in health. The resulting “GLOBE” study (Dutch acronym for Health and Living Conditions of the Population of Eindhoven and surroundings) was initiated in 1991 at the Department of Public Health of Erasmus Medical Centre Rotterdam, in cooperation with the municipal health services in the region of Eindhoven in which the study was conducted. The study has been and is supported by grants of the Ministry of Public Health, Welfare and Sport, the Sick Fund Council, the Netherlands Organisation for Advancement of Research, Erasmus University, and the Health Research and Development Council.

The main aim of the GLOBE study was “to make a quantitative assessment of the contribution of mechanisms and groups of factors to the explanation of socioeconomic inequalities in health in the Netherlands”.<sup>3</sup> Two main mechanisms were hypothesized to contribute to the occurrence of socioeconomic inequalities in health: a) social causation, in which determinants of health are differentially distributed across groups with a higher and SEP and b) selection mechanisms. With regard to social causation, and following the

explanations outlined in the Black Report, main explanations mediating between SEP and health were sought in material, cultural and behavioural factors. Further, specific attention was given to the potential role of differential health care access and to socioeconomic and health related factors in childhood. With regard to selection, both direct selection (with health determining SEP) and indirect selection mechanisms (with determinants of health influencing both SEP and health) were hypothesized to contribute to inequalities in health. In order to be able to disentangle social causation and selection mechanisms, a prospective cohort design was needed. The study added other variables in order to explore potential “new” explanations at later waves of data collection. For example, the postal survey in 1997 included psychosocial factors, in response to the growing attention for such factors in the explanation of inequalities in health.<sup>4</sup>

In 2004, the main aim of the study was to investigate the explanation of socio-economic inequalities in health-related behaviours (smoking, physical inactivity, and low fruit and vegetable intake) with a special emphasis on the role of environmental characteristics.<sup>5</sup> The conceptual framework (Figure 1) distinguished environmental characteristics of the neighbourhood, household, and work setting, and these environmental characteristics were thought to be linked to health-related behaviours via individual characteristics as derived from the Theory of Planned Behaviour.<sup>6</sup> In 2011, data collection was extended by indicators of general and behaviour specific norms and values, in order to explore the role of “cultural capital” in socioeconomic inequalities in food choice behaviour.<sup>7</sup> In 2012, interviews among participants of the 2011-survey were held, and included original items for cultural capital in adulthood and youth, and items on eating habits over the life course, cooking skills and food rules.

## ***Who is in the cohort?***

For the baseline measurement in 1991, an aselect sample, stratified by age, degree of urbanization and socio-economic status, of 27,070 non-institutionalised subjects aged between 15 and 75 years were recruited via the municipal registries of the city of Eindhoven and 15 surrounding villages (total source population n=373,509) in the Southern part of the Netherlands. Eindhoven and surroundings was chosen as study location, because it was reasonably representative for the Netherlands. Those in the sample received a postal questionnaire in Dutch. The response was 70.1%, which resulted in 18,973 study participants. This reasonably good response was perhaps the result of an intense strategy to encourage individuals to participate. For example, all general practitioners (GP) in the catchment area received information about the background of the study. In the invitation letter, potential participants were referred to their GP for additional information. Differences in response by socio-demographic factors were modest: a slightly lower response was found among men as compared to women, younger as compared to older persons, socioeconomically deprived as compared to affluent neighbourhoods as based on zip codes and city residents as compared to country-dwellers (Table 1).<sup>8</sup>

## Table 1 ##

Two subsamples of baseline survey respondents were invited to participate additional in-depth interviews. The first subsample was a random sample of baseline survey respondents (IR) ; a total of 2,800 survey respondents participated in an interview (response 79.3%). The second subsample included an overrepresentation of chronically ill persons, based on self-reported information about chronic diseases (coronary heart disease, diabetes mellitus, COPD or back problems) in the baseline survey (IC); a total of 2,867 persons participated in this

interview (response 72.3%). This overrepresentation was needed in order to investigate the role of health care access to inequalities in health. These two subsamples (n=5,667) formed the cohort invited for participation in subsequent waves of data collection. It was not possible for participants to be in both subsamples.

### ***How often have they been followed up?***

The first (“random”) subsample (IR) was interviewed in 1993 and 1995; the second (“chronically ill”) subsample (IC) was interviewed in 1992, 1993, 1994, and 1995. In 1997 a postal survey was sent to both subsamples: 4,947 persons were invited (from the two baseline samples persons had died (n=360), refused to further participate (n=287), emigrated (n=40), or could not be traced (n=33)). Among those approached, 4,246 persons participated in the survey (response 85.8%) and they were additionally interviewed at home. With only few persons participating in the survey or sample only, information from both the survey and the interview was available for 4,091 persons (response 82.7%).

In 2004, eligible participants of both baseline samples (n=4,347) were invited again to fill in a postal survey.<sup>5</sup> This population allowed answering research questions based on repeated measurements over a period of 13 years (1991 – 2004). Next to approaching these members of the two baseline sub-samples, two samples were added to the study in 2004. First, “new” participants were invited in the study (n=3,734), as attrition after 13 years of follow up had become selective. This sample now also included persons from ethnic minorities. Inclusion of this sample allowed answering new research questions using a cross-sectional design in 2004. In order to be able to compare prevalence rates in 2004 with those in 1991, this cross-sectional sample should come from the same source population (residents born in the Netherlands, residing in Eindhoven and surroundings and aged between 15 and 74 years).

Given that the youngest baseline participants were just over 25 years in 2004, we asked municipalities for residents aged 25 years and older. Second, a sample of GLOBE-participants who resided in the city of Eindhoven in 1991 and still resided there in 2004 (n=2,190) was invited to fill in the 2004 postal questionnaire. This sample increased the available study population for longitudinal studies on the role of neighbourhood deprivation for health. After excluding persons who had died after we updated addresses or who had incorrect addresses (n=373), a total of 9,898 persons were potentially able to return the questionnaire; with a response of 64.4%, information became available for 6,377 persons. Non-response again appeared to be slightly selective: compared to those who responded to the questionnaire, non-responders were significantly more often younger, and resided more often in the quartile of neighbourhood with the highest neighbourhood income quartile (Table 1). Using data from the baseline samples and these two additional samples, cross-sectional analyses could now be conducted with a sample representative for the source population of residents aged between 25 and 74 years residing in Eindhoven and born in the Netherlands (n=4,785, persons older than 75 were not invited in 2004, and cohort members of 75 year and older are therefore also not included in the “cross-sectional” sample).<sup>9</sup>

In 2005, two sub-samples of 306 and 284 respondents selected among respondents of the 2004 survey and living in seven of the most deprived and seven of the most affluent neighbourhoods of Eindhoven respectively, were invited for an interview. With a response of 68.6% in the deprived and 72.4% in the affluent neighbourhoods, interviews were conducted among 210 and 217 persons respectively.

In 2011, all available respondents to the questionnaire in 2004 (n=5,755) were invited again to fill in a postal survey. Between 2004 and 2011, a substantial number of participants had died



(n=531), others were emigrated (n=89), or could not be traced (n=1). With a response of 67.1%, information became available from 3,863 participants. Table 1 provides the composition of the sample sizes for the postal surveys and interviews. A total number of 2,755 persons participated in 1991, 1997, 2004 and 2011. Finally, in 2012 a subsample of participants on the postal survey in 2011 were invited for an oral interview; with 402 persons participating, the response was 70%.

### ***What has been measured?***

Data have mainly been collected via postal surveys and oral interviews. In most years information was asked on a wide range of indicators of SEP, material and social deprivation, health-related behaviours and health outcomes. Table 2 provides an overview of the categories of variables that have been measured by type of data collection and year of measurement.

## TABLE 2 HERE ##

To answer the research questions in 2004, three steps were taken in the data collection. Firstly, two focus groups were conducted among individuals with high education residing in one of the eight most affluent neighbourhoods of Eindhoven, and two groups among individuals with low education residing in one of the eight most deprived neighbourhoods. They were conducted to investigate whether environmental factors (as captured by the conceptual model) were indeed perceived as relevant for participants' health behaviours, and whether additional environmental factors were perceived relevant by participants. Secondly, a postal survey was set out. In addition to indicators of SEP and health behaviours, it included neighbourhood perceptions of a) social neighbourhood characteristics (such as incivilities,

safety and length of residence), and b) physical characteristics (attractiveness and absence of facilities) and prices. Household environmental characteristics asked for included material (e.g. meeting ends financially) and social deprivation (e.g. having friends or family over for dinner). Work-related environmental characteristics included physical working conditions and job control.<sup>10</sup> Individual-level characteristics included were predominantly measured for physical activity and included outcome expectancies, social norms, self-efficacy, barriers and the 'intention to change' in relation to physical activity. Environmental barriers were also assessed for fruit and vegetable consumption. Thirdly, to measure perceptions of environmental factors extensively and to explore the pathways between environmental factors and health-related behaviours via individual-level characteristics, in-depth interviews were conducted among 210 participants residing in seven socio-economically disadvantaged neighbourhoods, and 217 participants living in seven advantaged neighbourhoods of the city of Eindhoven. As an extension of the postal survey, important neighbourhood physical environmental perceptions asked for in more detail included a) the aesthetics of the environment, b) safety, and c) the availability of neighbourhood facilities (specifically shops, schools public transport and sports facilities). Because perceptions of neighbourhoods may differ from objective characteristics, a neighbourhood audit instrument was developed and used to assess characteristics of the objective physical environment in seven of the most deprived and seven of the most affluent neighbourhoods in the city of Eindhoven.<sup>11</sup>

## **Data linkage**

Information from the baseline postal survey onwards can and has been linked to three main databases: a) Cause-specific death registers from Statistics Netherlands, b) the National Medical Register including hospital admission information from all Dutch individuals, and c) the Regional Cancer Surveillance South. Combining the information from the baseline postal

survey (SEP, potentially mediating factors) with “objective” health outcomes allowed investigating (the explanation of) socioeconomic inequalities in such outcome measures. The use of personal data in the GLOBE study is in compliance with the Dutch Personal Data Protection Act and the Municipal Database Act, and has been registered with the Dutch Data Protection Authority (number 1248943).

According to the most recent linkage with the Death Registers from Statistics Netherlands (December 2007), a total of 3,372 among the 18,973 persons participating in the baseline postal survey had died after almost 17 years of follow up. A recent linkage with the Eindhoven Cancer Registry (December 2009) showed that 2,576 primary tumours were diagnosed within the region covered by the cancer registry in this population.<sup>12</sup> The most recent linkage with the National Medical Register has been conducted in 2004. Renewed linkages with these databases will yield higher numbers of deaths, hospital admissions and cancer cases in the future. Such a new linkage however, depends on relevant research questions and available financial resources.

### ***What has it found? Key findings and publications***

The study has thus far resulted in 83 scientific papers. A list of these publications is added as supplementary file to this paper (Supplement 1). These studies mainly focused on socioeconomic inequalities in health and health-related behaviours, although some studied other topics including successful aging.<sup>13 14</sup> A summary of results of studies on socioeconomic inequalities in health after ten years of the study has been published in 2004.<sup>15</sup> Briefly, the study found evidence of socioeconomic inequalities in mortality<sup>16 17</sup>, self-assessed health,<sup>10 18-23</sup> hospital-based incidence of several diseases (ischemic heart diseases, acute myocardial infarction, injuries, hip fractures)<sup>24-28</sup>, cancer incidence<sup>29 30</sup> and self-

reported chronic diseases.<sup>31-33</sup> Although some evidence of selection mechanisms were found<sup>34</sup>, social causation appeared to be more important in the explanation of these inequalities. Evidence was found for a role of material, behavioural and psychosocial factors in the explanation of these inequalities. While material factors played a dominant role in the explanation, the study showed that they exerted their influence on health partly via behavioural and psychosocial factors.<sup>16 17</sup> Some evidence was found for a role of childhood socioeconomic factors<sup>29 35-37</sup>; only little evidence was generated for a role of differential access to health care.<sup>38</sup> These findings have yielded important advises for the Dutch government for policies aimed at the reduction of socioeconomic inequalities in health.<sup>39 40</sup>

The increasing recognition of the importance of place characteristics for health<sup>41 42</sup> resulted in a series of multilevel analyses, in which it was shown that residing in socioeconomically disadvantaged neighbourhoods was related to mortality<sup>43</sup>, self-assessed health<sup>44</sup>, overweight and obesity<sup>45</sup>, smoking<sup>46</sup> and physical inactivity<sup>47</sup> after taking into account the composition in terms of individual level SEP. Little evidence was found that health determined moving to more or less affluent neighbourhoods.<sup>48</sup> These findings contributed to the focus of the study on the identification of specific environmental characteristics related to mainly behavioural outcomes, and which varied between neighbourhoods of different levels of welfare from 2004 onwards.

Some elements of the neighbourhood living environment were related to health behaviours. For example, measures of social safety, aesthetics, proximity of facilities and social cohesion were associated with aspects of physical activity<sup>9 47 49</sup>; some, but not all (e.g. the proximity to sports facilities) were differentially distributed across neighbourhoods of different welfare levels.<sup>47</sup> These findings subsequently led us to also study the interaction between environmental and individual levels factors with regards to physical activity.<sup>50</sup> Some first

indications were found that perceived safety interacts with individual cognitions in their association with sport participation. Although we observed clear inequalities in a healthy dietary intake, a role for physical environmental characteristics as observed in US studies<sup>51-53</sup>, could not be demonstrated in our study.<sup>54 55</sup> The poor understanding of socioeconomic inequalities in (un)healthy food choices<sup>54</sup> has been the rationale for a focus on this theme in the wave of data collection in 2011.

### ***What are the main strengths and weaknesses?***

A main strength for studying socioeconomic inequalities in health is the inclusion of a wide variety of potentially explanatory factors for health inequalities, including material, behavioural, psychological and environmental factors. This allows us to put the role of intermediary factors in a larger social context, as advocated by current social-ecological models. A main limitation of the study is that residents from non-western ethnicities are underrepresented. Another limitation of the study is the absence of information about biological risk factors for chronic diseases, such as blood pressure and serum cholesterol levels.

### ***Can I get hold of the data? Where can I find out more?***

Our large dataset, including many variables with multiple measurements over time, has up till now mostly been used for studies on socioeconomic inequalities in health. Yet, there are good examples of studies using our data for other purposes. De Kluizenaar et al. recently linked the GLOBE data to information about traffic noise and showed a significant association between noise exposure and the risk of getting up tired and not rested in the morning.<sup>56</sup> Following previous research in the GLOBE study on inequalities in health by marital status<sup>57 58</sup>, Keizer et al. found that fathers with children had lower mortality risks compared with childless men,

which appeared to be to a large extent due to differences in socioeconomic indicators, health behaviours and partner status.<sup>59</sup> With the GLOBE study population getting increasingly older, opportunities become available for answering social epidemiological analyses on healthy aging, over and above work that has already been done in this area of research.<sup>13 14</sup> These examples illustrate that possibilities to employ data expand the capacity of the current research group. Researchers are cordially invited to propose research based on the data. Any such requests can be forwarded to the corresponding author and project leader of the study (f.vanlenthe@erasmusmc.nl).

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