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Quantifying digital health inequality across a national healthcare system

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ABSTRACT

Objectives Digital health inequality, observed as differential utilisation of digital tools between population groups, has not previously been quantified in the National Health Service (NHS). Deployment of universal digital health interventions, including a national smartphone app and online primary care services, allows measurement of digital inequality across a nation. We aimed to measure population factors associated with digital utilisation across 6356 primary care providers serving the population of England.

Methods We used multivariable regression to test association of population and provider characteristics (including patient demographics, socioeconomic deprivation, disease burden, prescribing burden, geography and healthcare provider resource) with activation of two independent digital services during 2021/2022.

Results We find a significant adjusted association between increased population deprivation and reduced digital utilisation across both interventions. Multivariable regression coefficients for most deprived quintiles correspond to 4.27 million patients across England where deprivation is associated with non-activation of the NHS App.

Conclusion Results are concerning for technologically driven widening of healthcare inequalities. Targeted incentive to digital is necessary to prevent digital disparity from becoming health outcomes disparity.

INTRODUCTION

The past decade has seen increasing evidence in the use of digital health tools,[1] and general agreement that digital access and utilisation are important determinants of health.[2] There is recognition that these determinants are associated with socioeconomic and demographic factors.[3] Rapid digital transformation, therefore, raises concerns regarding digital health inequality for the most vulnerable.[4 5]

Observationally quantifying such inequalities is vital to understanding implications of digital health as a policy objective (eg, the National Health Service (NHS) 'Digital First' strategy[6 7]). We, therefore, measured adjusted association of socioeconomic and demographic factors with differential digital utilisation across the population of England.

METHODS

We consider two NHS interventions: an official smartphone application ('NHS App') for accessing services and records; and online portals for managing primary care interactions. These are universally available and provide unique conditions for observational analysis. We used digital product activation as a surrogate for utilisation.

Metadata at October 2022 demonstrates more than 37 million patients activated on the NHS App (67.9% of population, figure 1A), and more than 34 million (61.9%) on primary care portals, across 6356 practices. Multivariable analyses were performed at practice level. Covariables included socioeconomic deprivation and ethnicity, and factors associated with service demand and provider resource, including age, geography, disease and medication burden, and provider characteristics and staffing. Full methods reported in online supplemental materials.

RESULTS

Increased population from the two most socioeconomically deprived quintiles was associated with reduced NHS App activation (quintile 1: coef −0.223, 97.5% CI −0.232 to −0.213, p<0.001; quintile 2: coef −0.117, 97.5% CI −0.128 to −0.106, p<0.001). The least deprived quintile was associated with greater activation (coef 0.121, 97.5% CI 0.111 to 0.131, p<0.001). Other notable associations were seen with age (76–85 years: coef −0.177, 97.5% CI −0.312 to −0.041, p=0.011) and urbanity/rurality (urban: coef 0.043, 97.5% CI 0.037 to 0.049, p<0.001).

Similar findings were found in primary care portals, with negative association of deprived quintiles (quintile 1: coef −2.047, 97.5% CI −2.247 to −1.847, p<0.001; quintile 2: coef −1.114, 97.5% CI −1.348 to −0.880, p<0.001),

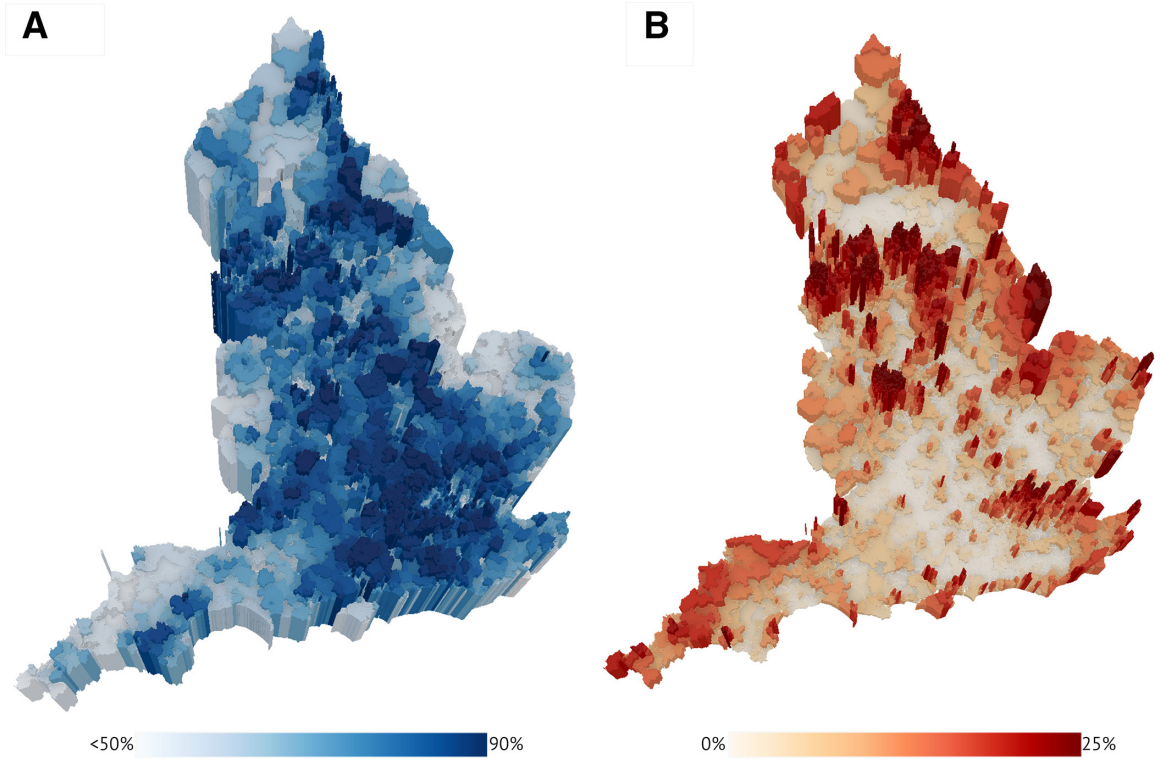

Figure 1 Three-dimensional choropleth maps showing (A) percentage of population with activated accounts on the NHS App at the level of middle layer super output (MSOA) geographical units; (B) estimated percentage of population where NHS App non-usage is associated with presence in lowest two deprivation quintiles at MSOA level, derived from regression coefficients in multivariable model and per-practice activation metadata. Values are represented by both colour and height of each unit. NHS, National Health Service.

and positive association with the least deprived (coef 1.269, 97.5% CI 1.055 to 1.482, p<0.001). Directional associations across age and urbanity/rurality were preserved.

Minority ethnicities (black and Asian populations) showed negative association in univariate analyses but were not significant when adjusted. Full results are in online supplemental materials.

DISCUSSION

Digital inequality between socioeconomic strata is substantial. When translated to populace, we estimate deprivation in the lowest two quintiles to be associated with reduced NHS app uptake in 4.27 million patients across England (figure 1B). Lack of adjusted ethnicity association can be attributed to competing effects from other covariables within the given population.

This study's primary value is objective measurement of the scale of digital inequality as observed in a natural experiment. It is limited by inability to directly measure extent of usage, and inability to adjust for confounders such as digital literacy and device/infrastructure availability. These may account for some of the socioeconomic effect. Limitations are discussed in online supplemental materials.

Our findings are concerning as the NHS aims to make apps the 'front door' to healthcare.[6] Results suggest that general policy application may worsen healthcare access inequality, and it is imperative that there is frank and open discussion about equitable digital technology implementation. We, therefore, offer three recommendations as a starting point.

First, digital transformation must be context-specific, based on local understanding. Infrastructure, education and engagement are obvious keys, but effective approaches will be tailored to specific populations. There is a basis for NHS programmes driven by organisations such as integrated care systems that can build strong community links.

Second, digital equality may not be fully achievable, but this is not necessarily a reason to decelerate. Rather, digitally enhanced pathways may offer efficiency savings that can be redirected to vulnerable and marginalised populations. Key actions should include proactive identification of populations at highest risk of digital exclusion, for targeted attention. Initiatives supporting shared learning, such as the National Healthcare Inequalities Improvement Programme, are vital for replicating successful pathways.

Finally, equity should be embedded into digital technology assessment.[8] Digital health inequality is at risk of becoming a buzzword. Actionable steps include publishing data to monitor disparities in uptake and outcomes, both at baseline and throughout the post-market lifecycle.

CONCLUSION

We have demonstrated substantial socioeconomic inequality in digital health utilisation in NHS England. Such patterns will likely be observable in any health system undergoing rapid digital transformation. An approach that addresses needs of specific disadvantaged groups is urgently required to avoid worsening digital health inequality.

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