Health outcomes related to the provision of free, tangible goods: A systematic review

Nav Persaud, Liane Steiner, Hannah Woods, Tatiana Aratangy, Susitha Wanigaratne, Jane Polsky, Stephen Hwang, Gurleen Chahal, Andrew Pinto

1 Centre for Urban Health Solutions, St. Michael’s Hospital, Toronto, Canada, 2 Department of Family and Community Medicine, St. Michael’s Hospital, Toronto, Canada, 3 Department of Family and Community Medicine, Faculty of Medicine, University of Toronto, Toronto, Canada, 4 Division of General Internal Medicine, University of Toronto, Toronto, Canada, 5 The Upstream Lab, Centre for Urban Health Solutions, Li Ka Shing Knowledge Institute, St. Michael’s Hospital, Toronto, Canada, 6 Dalla Lana School of Public Health, University of Toronto, Toronto, Canada

* nav.persaud@utoronto.ca

Abstract

Background

Free provision of tangible goods that may improve health is one approach to addressing discrepancies in health outcomes related to income, yet it is unclear whether providing goods for free improves health. We systematically reviewed the literature that reported the association between the free provision of tangible goods and health outcomes.

Methods

A search was performed for relevant literature in all languages from 1995-May 2017. Eligible studies were observational and experimental which had at least one tangible item provided for free and had at least one quantitative measure of health. Studies were excluded if the intervention was primarily a service and the free good was relatively unimportant; if the good was a medication; or if the data in a study was duplicated in another study. Covidence screening software was used to manage articles for two levels of screening. Data was extracted using an adaption of the Cochrane data collection template. Health outcomes, those that affect the quality or duration of life, are the outcomes of interest. The study was registered with PROSPERO (CRD42017069463).

Findings

The initial search identified 3370 articles and 59 were included in the final set with a range of 20 to 252 246 participants. The risk of bias assessment revealed that overall, the studies were of medium to high quality. Among the studies included in this review, 80 health outcomes were statistically significant favouring the intervention, 19 health outcomes were statistically significant favouring the control, 141 health outcomes were not significant and significance was unknown for 28 health outcomes.
Interpretation

The results of this systematic review provide evidence that free goods can improve health outcomes in certain circumstances, although there were important gaps and limitations in the existing literature.

Introduction

Disparities in health along socioeconomic lines are well established: groups with lower income and socioeconomic position consistently experience worse health outcomes, including higher rates of mortality.[1, 2] One of many possible explanations for better health outcomes among those with higher socioeconomic status is that income allows greater access to tangible goods that can improve health, such as safe shelter, healthy foods, clean water, and essential medicines. Worse health outcomes among lower socioeconomic status groups may be explained by reduced access to education and child care, exposure to hazards such as air pollution or contaminated drinking water, exposure to violence, reduced access to health care services, or discrimination based on gender, ethnicity or other characteristics.[3, 4] Some of these potential alternative explanations may be indirectly related to access to tangible goods, such as water filtration systems that can mitigate effects of contaminated water and medicines that may mitigate the effects of poor access to health care services. The importance of tangible goods has long been recognized through accounting for “non-cash” income, such as the value of housing provided by governments, and by defining poverty based on the cost of tangible goods (as in reference budgets that are baskets of goods and services that are considered necessary to reach an acceptable standard of living for an individual household within a given country, region or city) and essential services rather than based on relative income level.[5, 6]

If people lack a good that is required for their health and well-being, a simple response is to provide it for free. This approach appears to underpin many governmental and non-governmental programs routinely devote substantial resources to distributing goods to people in need.[7–9] Yet it is unclear whether providing goods for free promotes health. Free tangible goods may not be used as intended or at all: their positive health effects may not overcome other causes of poor health, or they may even cause unintended harm (e.g. providing safety equipment such as bicycle helmets could encourage risky behavior).[10] Providing people with free goods could complement other efforts to promote health, such as providing services like healthcare,[11] and providing a Basic Income.[12, 13] The receipt of free tangible goods could free up limited household income or resources that would otherwise be consumed in obtaining those goods and this additional disposable income may result in improved health.

We are not aware of any previous systematic effort in the existing scientific literature to assess whether providing free goods promotes health. We systematically reviewed the literature for studies that reported the association between the free provision of tangible goods and health outcomes.

Methods

Search strategy

A search strategy was developed in consultation with an information specialist. This systematic review was registered on PROSPERO (CRD42017069463, Aug 30 2017).

We defined “tangible goods” as a physical good or object that could be given to persons or families. We generated a list of items which were hypothesized to be distributed without charge to patients or study participants. The list of items was sent to several other researchers for
feedback who had expertise in primary health care, social determinants of health, health economics, epidemiology, public health, homelessness, housing, refugee health, access to healthy food and income security. After feedback was received, a final list of key terms was created with all suggestions included (S1 File, Search strategy).

Key terms were searched in the following databases: EMBASE, MEDLINE, CINAHL, PsycINFO, Cochrane, ProQuest databases (others could include Applied Social Sciences Index and Abstracts (ASSIA), FRANCIS, International Bibliography of the Social Sciences (IBSS), PAIS International, ProQuest Family Health, ProQuest, Social Services Abstracts, Sociological Abstracts) in all languages from 1995-present. We also looked through trial registries. The search was conducted in June 2017.

**Inclusion criteria**

Eligible studies were observational (e.g. case-control, cohort, before-after, pre-post or longitudinal), and experimental studies (e.g. randomized controlled trial), which had at least one tangible item provided free of cost to participants. Examples of free goods included transit passes, food boxes, infant goods, bicycle helmets, condoms, needles, and other drug paraphernalia. Studies had to have at least one quantitative measure of health. We understood “health” as the quality or duration of life. Although housing retention is not a health outcome, it was treated as such because housing is closely related to quality of life.[14] Included studies were also required to have a comparison or control group that allowed the effect of the free good to be measured. Studies published between January 1995 and May 2017 were eligible.

**Exclusion criteria**

We excluded studies in which a service such as advice, health screening procedure or a diagnostic test was provided; if the intervention was primarily a service and the free good was relatively unimportant (e.g. giving participants a voucher for a health service); if the good was a medication (e.g. nicotine replacement, contraception, naloxone kits); or if the data in a study was duplicated in another study (duplicated data was defined as data from the same participant at the same timepoint).

**Screening**

Covidence screening software [15] was used to manage articles while screening. In level one screening, all titles and abstracts were reviewed to determine if they met the inclusion criteria for the study. Level two consisted of screening the full text of articles to determine whether they met the inclusion criteria. Each article was appraised by two reviewers (LS and HW) for both levels and disagreements were discussed. If the reviewers did not come to a decision, a third investigator (NP) was consulted.

We attempted to include only one report of each health outcome. We excluded reports where both the outcomes and participants were the same as a study that was already included. We included reports where the participants and outcomes only partially overlapped between reports. If multiple reports included the same outcome for the same participants, we included that outcome only once.

**Extraction technique**

Publication information, study characteristics, participant demographics, the health outcomes measured in the study and the quantitative results were extracted from each study by one reviewer using an adaptation of the Cochrane data collection template. [16]
Quality appraisal

The quality of each article was appraised by two individual reviewers using the Cochrane Risk of Bias assessment tool for randomized control trials [17] and ROBINS 1 assessment tool for non-randomized control trials [18]. The Cochrane Risk of Bias tool assesses seven potential sources of bias including random sequence generation, allocation concealment, blinding of participants, blinding of outcome assessments, incomplete outcome data, selective reporting, and funding source. [17] The ROBINS 1 tool also assesses seven potential sources of bias including bias due to confounding, bias in selection of participants into the study, bias in classification of interventions, bias due to deviations from intended interventions, bias due to missing data, bias in measurement of outcomes, and bias in selection of the reported results. [18] We did not exclude any studies based on the risk of bias assessment.

Presentation of findings

We grouped studies based on the type of free good provided and the outcome reported.

Results

Literature search

The initial search identified 3370 articles of interest. In the first level of screening based on abstract review, 3132 articles were excluded, leaving 238 articles for full manuscript review. This second level of screening removed a further 179 articles yielding a final set of 59 articles which met full eligibility criteria (Fig 1).

Study characteristics

The 59 included studies included a range of 20 to 252 246 participants with a median of 872.5. The length of the studies ranged from two to 180 months with a median of 15.5 months. Of the 59 articles, 29 were randomized controlled trials (RCTs) and 30 were observational studies.

Among the 59 included studies, 45 (76.3%) were from countries that are considered high income according to the 2016 World Bank Report. [20] These countries included the USA (20 studies), Canada (13 studies), United Kingdom (four studies), Norway (two studies), Israel (two studies), Ireland (one study), New Zealand (one study), Australia (one study), and France (one study). Fourteen studies (23.7%) were from countries considered low or medium income by the 2016 World Bank Report. [20] These countries included India (three studies), Cameroon (two studies), and one study each from Mexico, Colombia, Ukraine, Pakistan, Ghana, Kenya, Nigeria, China and Zanzibar.

Among the 59 included studies, the free goods provided were housing (20 studies), food (17 studies), safety equipment (six studies), insecticide treated nets (five studies), hygiene, and water sanitation (six studies) and miscellaneous (five studies).

Risk of bias

Among the RCTs there were: no studies judged to be at a low risk of bias in all domains, one (3.4%) study was at a low or unknown risk of bias for all domains and 28 (96.6%) studies were at a high risk of bias in at least one domain (Fig 2). Among observational studies, there was: one (3.3%) study judged to be at a low risk of bias or no information in all domains, 11 (36.7%) studies at a low or moderate risk of bias or no information for all domains, 13 (43.3%) studies at serious risk of bias in at least one domain (but not at critical risk of bias in any domain), and five (16.7%) studies at critical risk of bias in at least one domain (Fig 3). Risk of
bias assessment data is available as S1 Table, Cochrane risk of bias assessment for RCTs and S2 Table, ROBINS 1 risk of bias assessment for observational studies.

**Results by type of good**

**Housing.** There were 24,940 participants in the 20 housing studies (there was some overlap in participants between studies; see the Methods section) (Table 1). All studies were
conducted in either Canada (12 studies) or the USA (eight studies). Nineteen of these studies (95%) had a co-intervention, of which eighteen were “Housing First” programs. For example, in addition to housing, the intervention offered participants treatment for various addictions, mental health challenges and other social supports. [21] The primary reported outcomes in housing studies were stable housing (11 studies, 55%); substance use (10 studies, 50%); psychiatric symptoms or mental health (eight studies, 40%); quality of life, including QoLI-20, community functioning (MCAS) and community integration (CIS-PHY and CIS-PSYCH) (eight studies, 40%); health status, including BMI, waist circumference, physical health ailments and health assessments using EQ5D-VAS, and physical SF-12 assessment forms (six studies, 30%); food security (two studies, 10%); and death (one study, 5%). The study durations ranged from six months to 180 months. Housing studies reported a total of 114 outcomes (with duplicates removed), of which 42 were statistically significant, 62 were not significant, and significance was unknown for 10 outcomes. Of the 42 statistically significant outcomes, 37 outcomes (from 15 different studies) favoured the intervention, and five outcomes (from two different studies) favoured the control.

**Food.** There were 307,583 participants in the 17 food studies (Table 2). Food studies were conducted in USA (11 studies), Norway (two studies), Mexico (one study), Colombia (one study), and Canada (one study). The primary reported outcomes in food studies were food security (two studies, 10%); health status, including BMI, waist circumference, physical health ailments and health assessments using EQ5D-VAS, and physical SF-12 assessment forms (six studies, 30%); food security (two studies, 10%); and death (one study, 5%). The study durations ranged from six months to 180 months. Food studies reported a total of 114 outcomes (with duplicates removed), of which 42 were statistically significant, 62 were not significant, and significance was unknown for 10 outcomes. Of the 42 statistically significant outcomes, 37 outcomes (from 15 different studies) favoured the intervention, and five outcomes (from two different studies) favoured the control.
Table 1. Characteristics of included housing studies (N = 20).

| Study                        | Study type | Country | Participants | Intervention vs. Comparison | Co-intervention | Time   | Health Outcome                  | Results |
|------------------------------|------------|---------|--------------|-----------------------------|-----------------|--------|---------------------------------|---------|
| Tenhere 2004 [21]            | RCT        | USA     | 225 homeless adults with serious mental illness | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 24 months | Residential stability            | $F_{5,27} = 27.7, p < 0.001$ |
|                              |            |         |              |                             |                 |        | Alcohol use                     | $F_{5,27} = 1.1, p = 0.38$ (favors control) |
|                              |            |         |              |                             |                 |        | Drug use                        | $F_{5,27} = 0.48, p = 0.74$ (favors control) |
|                              |            |         |              |                             |                 |        | Psychiatric symptoms            | $F_{5,27} = 0.48, p = 0.80$ (favors control) |
|                              |            |         |              |                             |                 |        | Decrease in homeless status      | $F_{5,27} = 10.1, p = 0.001$ |
| Stefancic 2007 [22]          | RCT        | USA     | 200 homeless adults with serious mental illness | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 47 months | Housing retention at 20 months | Intervention: 10% 20% Control: 15% | Not significant |
| Patell 2011 [23]             | Qualitative | USA     | 83 homeless adults with serious mental illness | Housing First vs treatment first | Participants in both groups had additional counseling and resources available | 12 months | Substance use during the program (number of people) | $\chi^2 = 8.40, df = 1, p = 0.004$ |
| Jacob 2013 [24]              | Observational | USA     | 11680 children in public housing with their family | Housing voucher vs no housing voucher | Participants in both groups had additional counseling and resources available | 12 months | Deaths from disease               | OR 0.91 (95%CI: 0.80–2.23, p = 0.84) (favors control) |
|                              |            |         |              |                             |                 |        | Accidental deaths                | OR 1.07 (95%CI: 0.64–1.79, p = 0.81) (favors control) |
| Montgomery 2013 [25]         | Observational | USA     | 177 homeless veterans with mental illness | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 12 months | Housing first treatment as usual association with residential stability | Adjusted incidence ratio 0.85 (95%CI: 0.79–1.05) |
| Patterson 2013 [26]          | RCT        | Canada  | 497 homeless adults with serious mental illness in Vancouver | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 12 months | QOL moderate needs               | Intervention: baseline 72.2 (SD: 21.6), follow up 91.3 (SD: 20.6), Control: baseline 72.8 (SD: 23.3), follow up 85.7 (SD: 23.2), p = 0.005 (favors control) |
| Paleps 2013 [27]             | Parallel RCT | Canada  | 497 homeless adults with serious mental illness in Vancouver | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 12 months | Housing first treatment as usual association with residential stability | Adjusted incidence ratio 0.85 (95%CI: 0.79–1.05) |
| Bean 2013 [28]               | Longitudinal | USA     | 20 medically vulnerable and homeless participants who received housing and peer support by Project HOPE | Baseline (at the day of move-in to housing), follow up (6 months after move-in) | Participant received peer support, additional counseling and resources available | 6 months | Physical-QOL, Baseline: 3.96 (SD: 0.82), follow up: 3.51 (SD: 0.65), p = 0.008 |
|                              |            |         |              |                             |                 |        | Psychological-QOL, Baseline: 3.29 (SD: 0.87), follow up: 3.66 (SD: 0.72), p = 0.05 |
|                              |            |         |              |                             |                 |        | Social Relationships, Baseline: 3.19 (SD: 0.90), follow up: 3.62 (SD: 0.87), p = 0.05 |
|                              |            |         |              |                             |                 |        | Environment-QOL, Baseline: 2.75 (SD: 0.69), follow up: 3.66 (SD: 0.67), p = 0.001 |
|                              |            |         |              |                             |                 |        | Diagnosed with a mental illness (people) | Baseline: 6, follow up: 8, p = 0.38 (favors control) |

(Continued)
| Study | Study type | Country | Participants | Intervention vs. Comparison | Co-intervention | Time | Health Outcome | Results |
|-------|------------|---------|--------------|-----------------------------|----------------|------|----------------|---------|
| Kessler 2014[29] | RCT | USA | 460 low income families living in assisted housing | Voucher to move to a low poverty area or unrestricted moving voucher vs no voucher | The low poverty voucher group received counseling | 12-18 months | Major depressive disorder: Low Poverty voucher group | Boys: OR 2.29 (95% CI: 1.2-3.9), p = 0.03; 95% CI: 1-7.3; p = 0.001 | |
| | | | | | | | Girls: OR 0.9 (95% CI: 0.3-2.1), p = 0.001 | |
| | | | | | | | Combined: OR 1 (95% CI: 1-2.8); p = 0.5 | |
| | | | | | | | Panic disorder: Low Poverty voucher group | Combined: OR 0.7 (95% CI: 0.4-1.1); p = 0.2 | |
| | | | | | | | Posttraumatic stress disorder: Low Poverty voucher group | Boys: OR 3.45 (95% CI: 1.6-7.4), p = 0.001 | |
| | | | | | | | Girls: OR 1.2 (95% CI: 0.8-1.8), p = 0.001 | |
| | | | | | | | Combined: OR 1.8 (95% CI: 1.2-2.7); p = 0.001 | |
| | | | | | | | Oppositional-defiant disorder: Low Poverty voucher group | Combined: OR 0.7 (95% CI: 0.5-1.1); p = 0.1 | |
| | | | | | | | Intermittent explosive disorder: Low Poverty voucher group | Combined: OR 0 (95% CI: 0.6-1); p = 0.01 | |
| | | | | | | | Conduct disorder: Low Poverty voucher group | Boys: OR 3.9 (95% CI: 1.5-9.8), p = 0.001 | |
| | | | | | | | Girls: OR 0.5 (95% CI: 0.2-1.4), p = 0.001 | |
| | | | | | | | Combined: OR 1.6 (95% CI: 1.2-2.1); p = 0.001 | |
| | | | | | | | Major depressive disorder: Traditional voucher group | Boys: OR 1.79 (95% CI: 0.9-3.9), p = 0.2 | |
| | | | | | | | Girls: OR 0.6 (95% CI: 0.3-0.9), p = 0.001 | |
| | | | | | | | Combined: OR 0.9 (95% CI: 0.6-1.3); p = 0.07 | |
| | | | | | | | Panic disorder: Traditional voucher group | Combined: OR 0.9 (95% CI: 0.5-1.4); p = 0.7 | |
| | | | | | | | Posttraumatic stress disorder: Traditional voucher group | Boys: OR 2.75 (95% CI: 1.5-8.0), p = 0.001 | |
| | | | | | | | Girls: OR 0.7 (95% CI: 0.3-1.7), p = 0.001 | |
| | | | | | | | Combined: OR 1.1 (95% CI: 0.7-1.7); p = 0.3 | |
| | | | | | | | Oppositional-defiant disorder: Traditional voucher group | Combined: OR 1 (95% CI: 0.8-1.3); p = 0.7 | |
| | | | | | | | Intermittent explosive disorder: Traditional voucher group | Combined: OR 0 (95% CI: 0.7-1.2); p = 0.7 | |
| | | | | | | | Conduct disorder: Traditional voucher group | Boys: OR 2.9 (95% CI: 0.8-9.3), p = 0.2 | |
| | | | | | | | Girls: OR 1.9 (95% CI: 0.9-3.9), p = 0.02 | |
| | | | | | | | Combined: OR 1.9 (95% CI: 0.9-2.1); p = 0.001 | |
| Aubry 2015[30] | RCT | Canada | 500 High need homeless adults with severe mental illness | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 12 months | Quality of Life (QOL) Mean change 7.27 (95% CI: 3.8-10.6); p < 0.001 | |
| | | | | | | | Substance misuse (GAIN SS) IRR 0.86 (95% CI: 0.65-1.1); p = 0.4 | |
| | | | | | | | Community functioning Mean change 1.81 (95% CI: 0.65-2.98); p = 0.003 | |
| | | | | | | | Percent of time stably housed moderate need Intensive Case Management (ICM) IRR 0.86 (95% CI: 0.23-0.91); p = 0.05 | |
| | | | | | | | Opioid use on 30 days IRR 0.86 (95% CI: 0.23-0.91); p = 0.05 | |
| | | | | | | | Daily substance use moderate need ICR AOR 0.78 (95% CI: 0.37-1.6); p = 0.3 | |
| Study                                      | Study type | Country | Participants | Intervention vs. Comparison | Co-intervention | Time | Health Outcome                                                                 | Results                                                                 |
|-------------------------------------------|------------|---------|--------------|----------------------------|-----------------|------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Stergiopulos 2015 [35]                    | RCT        | Canada  | 378 homeless adults with serious mental illness | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 24 months | Time in stable residence: Intervention: 75% (95% CI: 70.5–79.7); Control: 59.3% (95% CI: 53.3–64.2) | Change in mean difference: 1.25 (95% CI: -6.96–9.46); p = 0.66 (favors control) |
|   |                                        |          |              |                            |                  |      | Health status (EQ-5D-VAS)                                                        | Change in mean difference: 0.91 (95% CI: 0.85–1.0); p = 0.50 (favors control) |
|   |                                        |          |              |                            |                  |      | Substance use problem severity (GAIN-SU)                                         | Change in mean difference: 0.91 (95% CI: 0.85–1.0); p = 0.50 (favors control) |
|   |                                        |          |              |                            |                  |      | Psychological community integration (CIS-PHY)                                    | Change in mean difference: 0.91 (95% CI: 0.85–1.0); p = 0.50 (favors control) |
|   |                                        |          |              |                            |                  |      | Physical community integration (CIS-JPSYCH)                                       | Change in mean difference: 0.91 (95% CI: 0.85–1.0); p = 0.50 (favors control) |
|   |                                        |          |              |                            |                  |      | Quality of life (QoL)                                                            | Change in mean difference: 1.24 (95% CI: 1.18–1.30); p = 0.50 (favors control) |
| Woodhall-melink 2015[36]                   | RCT        | Canada  | 575 homeless adults with serious mental illness | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 24 months | BMI moderate needs: β0 = 0.00063; p = 0.99 (favors control) | Change in mean difference: 0.00063 (95% CI: 0.00050–0.00075); p = 0.99 (favors control) |
|                                           |            |         |              |                            |                  |      | BMI high needs: β0 = 0.00063; p = 0.99 (favors control) | Change in mean difference: 0.00063 (95% CI: 0.00050–0.00075); p = 0.99 (favors control) |
|                                           |            |         |              |                            |                  |      | Waist circumference- moderate needs β0 = 0.01; p = 0.001 (favors control) | Change in mean difference: 0.01 (95% CI: 0.000–0.021; p = 0.001 (favors control) |
|                                           |            |         |              |                            |                  |      | Waist circumference- high needs β0 = 0.01; p = 0.001 (favors control) | Change in mean difference: 0.01 (95% CI: 0.000–0.021; p = 0.001 (favors control) |
| Kozloff 2016 [37]                          | RCT        | Canada  | 156 homeless youth with serious mental illness | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 24 months | Days in stable housing: Adjusted mean difference: 34% (95% CI: 24–43); p = 0.001 | Change in mean difference: 2.81 (95% CI: -4.09 to 0.02); p = 0.08 (favors control) |
|   |                                        |          |              |                            |                  |      | Number of events Difference or ratio of changes from baseline (24 months) 0.64 (95% CI: 0.57–0.72); p = 0.001 (favors control) | Change in mean difference: 0.64 (95% CI: 0.57–0.72); p = 0.001 (favors control) |
|   |                                        |          |              |                            |                  |      | Health (EQ-5D) Difference or ratio of changes from baseline (24 months) 0.28 (95% CI: 0.16–0.40); p = 0.001 (favors control) | Change in mean difference: 0.28 (95% CI: 0.16–0.40); p = 0.001 (favors control) |
|   |                                        |          |              |                            |                  |      | QOLI-20 Difference or ratio of changes from baseline (24 months) 0.28 (95% CI: 0.16–0.40); p = 0.001 (favors control) | Change in mean difference: 0.28 (95% CI: 0.16–0.40); p = 0.001 (favors control) |
|   |                                        |          |              |                            |                  |      | MCAS Difference or ratio of changes from baseline (24 months) 0.28 (95% CI: 0.16–0.40); p = 0.001 (favors control) | Change in mean difference: 0.28 (95% CI: 0.16–0.40); p = 0.001 (favors control) |
|                                           |            |         |              |                            |                  |      | Community integration (CIS) Difference or ratio of changes from baseline (24 months) 0.99 (95% CI: 0.99–1.00); p = 0.8 (favors control) | Change in mean difference: 0.99 (95% CI: 0.99–1.00); p = 0.8 (favors control) |
|                                           |            |         |              |                            |                  |      | Recovery Assessment Scale (RAS) Difference or ratio of changes from baseline (24 months) 1.00 (95% CI: 1.00–1.00); p = 0.8 (favors control) | Change in mean difference: 1.00 (95% CI: 1.00–1.00); p = 0.8 (favors control) |
|                                           |            |         |              |                            |                  |      | Physical health (SF-12) Difference or ratio of changes from baseline (24 months) 1.45 (95% CI: 1.35–1.56); p = 0.5 (favors control) | Change in mean difference: 1.45 (95% CI: 1.35–1.56); p = 0.5 (favors control) |
|                                           |            |         |              |                            |                  |      | Mental health (SF-12) Difference or ratio of changes from baseline (24 months) 1.45 (95% CI: 1.35–1.56); p = 0.5 (favors control) | Change in mean difference: 1.45 (95% CI: 1.35–1.56); p = 0.5 (favors control) |
|                                           |            |         |              |                            |                  |      | Colorado Symptom Index (CSI) Difference or ratio of changes from baseline (24 months) 1.45 (95% CI: 1.35–1.56); p = 0.5 (favors control) | Change in mean difference: 1.45 (95% CI: 1.35–1.56); p = 0.5 (favors control) |
|                                           |            |         |              |                            |                  |      | GAIN-SFS Difference or ratio of changes from baseline (24 months) 1.45 (95% CI: 1.35–1.56); p = 0.5 (favors control) | Change in mean difference: 1.45 (95% CI: 1.35–1.56); p = 0.5 (favors control) |
|                                           |            |         |              |                            |                  |      | Violence of violent robbery, physical, or sexual assault Difference or ratio of changes from baseline (24 months) 1.45 (95% CI: 1.35–1.56); p = 0.5 (favors control) | Change in mean difference: 1.45 (95% CI: 1.35–1.56); p = 0.5 (favors control) |
| Stergiopulos 2016 [35]                     | Pragmatic RCT | Canada  | 237 moderate needs homeless adults with mental illness | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 24 months | Participants housed Intervention: 75% (95% CI: 70–79); Control: 45% (95% CI: 35–60) | Change in mean difference: 0.30 (95% CI: 0.18–0.42); p = 0.3 (favors control) |
|                                           |            |         |              |                            |                  |      | Number of events Ratio of rate ratios 1.06 (95% CI: 1.00–1.12); p = 0.05 (favors control) | Change in mean difference: 1.06 (95% CI: 1.00–1.12); p = 0.05 (favors control) |
|                                           |            |         |              |                            |                  |      | Number of days in past 30 incarcerated alcohol problems Ratio of rate ratios 0.24 (95% CI: 0.18–0.33); p = 0.5 (favors control) | Change in mean difference: 0.24 (95% CI: 0.18–0.33); p = 0.5 (favors control) |
|                                           |            |         |              |                            |                  |      | Number of days in past 30 incarcerated drug problems Ratio of rate ratios 0.24 (95% CI: 0.18–0.33); p = 0.5 (favors control) | Change in mean difference: 0.24 (95% CI: 0.18–0.33); p = 0.5 (favors control) |

(Continued)
| Study            | Study type | Country | Participants | Intervention vs. Comparison | Co-intervention | Time | Health Outcome | Results |
|------------------|------------|---------|--------------|------------------------------|-----------------|------|----------------|---------|
| Aubry 2016[37]  | RCT        | Canada  | 950 homeless adults with serious mental illness | Housing First with Assertive Community Treatment (ACT) vs treatment as usual | Participants in both groups had additional counseling and resources available | 48 months | Time housed in previous 3 months | Intervention: baseline 10.7% (SD: 7.1%); follow-up 72.8% (SD: 12.8%); Control: baseline 10.6% (SD: 6.9%); follow-up 41.7% (SD: 7.1%); unknown significance |
|                  |            |         |              |                              |                 |      | Days housed at final interview | Intervention: baseline 78.6% (SD: 16.1%); follow-up 72.8% (SD: 42.6%); Control: baseline 45.9% (SD: 26.3%); follow-up 35.6% (SD: 16.1%); unknown significance |
|                  |            |         |              |                              |                 |      | Present stable housing | Intervention follow-up: 74% (95% CI: 69–78%); Control: baselines 86% (SD: 18%); follow-up 41% (95% CI: 35–46%); unknown significance |
|                  |            |         |              |                              |                 |      | Length of stay (days) | Intervention follow-up: 280 (SD: 174); Control: follow-up 115 (SD: 133); unknown significance |
|                  |            |         |              |                              |                 |      | Percent stable housing | Intervention follow-up: 74% (95% CI: 69–78%); Control follow-up: 41% (95% CI: 35–46%); unknown significance |
|                  |            |         |              |                              |                 |      | Physical integration | Intervention: baseline 1 (SD: 1.1); follow-up 1 (SD: 1.2); Control: baseline 1 (SD: 1.2); follow-up 1 (SD: 1.2); unknown significance |
|                  |            |         |              |                              |                 |      | Psychological integration | Intervention: baseline 1 (SD: 1.1); follow-up 1 (SD: 1.2); Control: baseline 1 (SD: 1.2); follow-up 1 (SD: 1.2); unknown significance |
|                  |            |         |              |                              |                 |      | Health status (EQ-5D) | Intervention: baseline 0 (SD: 0.24); follow-up 0 (SD: 0.24); Control: baseline 0 (SD: 0.24); follow-up 0 (SD: 0.24); unknown significance |
|                  |            |         |              |                              |                 |      | Substance use problems (GAIN) | Intervention: baseline 1 (SD: 1.8); follow-up 1 (SD: 1.1); Control: baseline 1 (SD: 1.8); follow-up 1 (SD: 1.2); unknown significance |
|                  |            |         |              |                              |                 |      | Overall health | Combined: p = 0.003; unknown significance |
|                  |            |         |              |                              |                 |      | Quality of life | Combined: p = 0.002; unknown significance |
|                  |            |         |              |                              |                 |      | Recovery assessment | Combined: p = 0.002; unknown significance |

(Continued)
| Study | Study type | Country | Participants | Intervention vs. Comparison | Co-intervention | Time | Health Outcome | Results |
|-------|------------|---------|--------------|----------------------------|----------------|------|----------------|---------|
| O'Campo 2017 [40] | RCT | Canada | 2148 Homeless adults with serious mental illness | Housing First vs treatment as usual | Participants in both groups had additional counseling and resources available | 24 months | Homelessness duration ≥ 3 years moderate needs | Unadjusted OR 0.96 (95%CI: 0.92–0.98); p < 0.01 |
| | | | | | | | Community functioning variable: MCS total score moderate needs (lower scores are associated with poorer functioning) | Unadjusted OR 1.02 (95%CI: 0.99–1.06); p = 0.36 |
| | | | | | | | CSIL total score ≥ 20 moderate needs | Unadjusted OR 0.00 (95%CI: 0.00–0.01); p < 0.01 |
| | | | | | | | Days in the past month experienced alcohol problems moderate needs | Unadjusted OR 0.96 (95%CI: 0.95–0.97); p < 0.01 |
| | | | | | | | Days in the past month experienced drug problems moderate needs | Unadjusted OR 0.97 (95%CI: 0.96–0.98); p < 0.01 |
| | | | | | | | Physical health variables: Ulcer moderate needs | Unadjusted OR 0.95 (95%CI: 0.90–1.00); p = 0.048 favours control |
| | | | | | | | Physical health variables: bowel problems moderate needs | Unadjusted OR 0.85 (95%CI: 0.80–0.90); p = 0.011 favours control |
| | | | | | | | Physical health variables: high blood pressure moderate needs | Unadjusted OR 1.22 (95%CI: 0.84–1.48); p = 0.001 favours control |
| | | | | | | | Physical health variables: diabetes moderate needs | Unadjusted OR 1.02 (95%CI: 0.87–1.20); p = 0.816 |
| | | | | | | | Number of times participants achieved high or marginal food security: moderate needs Montreal | Rate ratio 1.02 (95%CI: 0.99–1.05); p = 0.441 |
| | | | | | | | Number of times participants achieved high or marginal food security: moderate needs Toronto | Rate ratio 1.02 (95%CI: 0.99–1.05); p = 0.441 |
| | | | | | | | Number of times participants achieved high or marginal food security: moderate needs Vancouver | Rate ratio 1.02 (95%CI: 0.99–1.05); p = 0.441 |
| | | | | | | | Number of times participants achieved high or marginal food security: marginal food security: high needs Moncton | Rate ratio 0.98 (95%CI: 0.78–1.24); p = 0.782 |
| | | | | | | | Number of times participants achieved high or marginal food security: marginal food security: high needs Montreal | Rate ratio 0.98 (95%CI: 0.78–1.24); p = 0.782 |
| | | | | | | | Number of times participants achieved high or marginal food security: marginal food security: high needs Toronto | Rate ratio 0.98 (95%CI: 0.78–1.24); p = 0.782 |
| | | | | | | | Number of times participants achieved high or marginal food security: marginal food security: high needs Vancouver | Rate ratio 0.98 (95%CI: 0.78–1.24); p = 0.782 |
| | | | | | | | Health outcomes related to the provision of free, tangible goods | Rate ratio 0.98 (95%CI: 0.91–1.17); p = 0.338 |

*Results favor the intervention unless indicated otherwise*
| Study | Study type | Country | Participants | Intervention vs. Comparison | Co-intervention | Time | Health Outcome | Results |
|-------|------------|---------|--------------|-----------------------------|----------------|------|----------------|---------|
| Murphy 1998 [2] | Cross sectional and longitudinal observations | USA | 169 Elementary school students | School breakfast program vs no school breakfast program | NR | 4 months | Depression (the children’s depression inventory scale) | Intervention: baseline 3; follow up 4.2; Control: baseline 7; follow up 6.8; p < 0.01 |
| | | | | | | | | The revised children’s manifest anxiety scale | Intervention: baseline 7; follow up 7.3; Control: baseline 114; follow up 7.3; p < 0.05 |
| | | | | | | | | Pediatric symptom checklist | Intervention: baseline 13; follow up 14.7; Control: baseline 109; follow up 14.7; p < 0.05 |
| Gibson 2003 [3] | Cohort | USA | 6731 Low income adults | Current Food Stamp Program (FSP) participation vs no current FSP participation | NR | NR | Obese (percent) | Follow-up: Intervention 29.3; Control 19.2; p < 0.05 | 
| | | | | | | | | Overweight but not obese (percent) | Follow-up: Intervention 29.3; Control 25.6; p < 0.05 | 
| | | | | | | | | Underweight (percent) | Follow-up: Intervention 3.5; Control 2.4; p < 0.05 | 
| | | | | | | | | BMI | Follow-up: Intervention 26.8 (SEM 0.5); Control 27.8 (SEM 0.6); p < 0.01 | 
| Gibson 2004 [4] | Cohort | USA | 7843 Children | Current Food Stamp Program (FSP) participation vs no current FSP participation | NR | NR | Overweight boys (percent) | Follow-up: Intervention 16.8; Control 17.4; p < 0.05 | 
| | | | | | | | | Overweight girls (percent) | Follow-up: Intervention 25.9; Control 24.6; p < 0.05 | 
| | | | | | | | | Underweight (percent) | Follow-up: Intervention 4.9; Control 5.2; p < 0.05 | 
| | | | | | | | | BMI girls | Follow-up: Intervention 19.6 (SEM 0.6); Control 19.5 (SEM 0.7); p < 0.05 | 
| | | | | | | | | Overweight girls | Follow-up: Intervention 18.9; Control 14.9; p < 0.05 | 
| | | | | | | | | BMI girls | Follow-up: Intervention 19.5 (SEM 0.1); Control 19.9 (SEM 0.2); p < 0.05 | 
| Ramirez-lopez 2005[5] | A quasi-experimental, longitudinal prospective study | Mexico | 610 School children | School breakfast program vs no school breakfast program | NR | NR | Body fat (percent) | Intervention: baseline 17.1 (SD 0.1); follow up 17.2 (SD 0.1); Control: baseline 17.1 (SD 0.2); follow up 16.9 (SD 0.2); p < 0.05 | 
| | | | | | | | | BMI | Intervention: baseline 14.6 (95%CI: 14.3–14.9); follow up 14.5 (95%CI: 14.2–14.8); Control: baseline 14.9 (95%CI: 14.7–15.0); follow up 14.6 (95%CI: 14.3–14.9); p < 0.05 | 
| | | | | | | | | Triglycerides (mg/dl) | Intervention: baseline 55.1 (95%CI: 54.8–55.3); follow up 55.4 (95%CI: 55.1–55.7); p < 0.05 | 
| | | | | | | | | Cholesterol (mg/dl) | Intervention: baseline 148.4 (95%CI: 148.3–148.5); follow up 148.3 (95%CI: 148.2–148.4); Control: baseline 148.5 (95%CI: 148.4–148.5); follow up 148.3 (95%CI: 148.2–148.3); p < 0.05 | 
| Lee 2007[6] | Retrospective longitudinal study | USA | 252, 248 Children in Illinois | Participant in food stamps, women infants and children (WIC) program vs no participants | WC includes nutrition, education and counseling | 60 months | Abuse | mean of outcomes 0.02; p < 0.05 | 
| | | | | | | | | Neglect | mean of outcomes 0.01; p < 0.05 |

(Continued)
| Study | Study type | Country | Participants | Intervention vs. Comparison | Co-intervention | Time | Health Outcome | Results |
|-------|------------|---------|--------------|-----------------------------|-----------------|------|----------------|---------|
| Arsenault 2009 | Observational | Colombia | 3202 Children enrolled in the public primary school system age 5-12 | School snack vs no school snack | NR | 5 months | Hemoglobin, Mean change 1 (95% CI: 0–2) | favours control | p = 0.001 |
| Arsenault 2009 | Observational | Colombia | 3202 Children enrolled in the public primary school system age 5-12 | School snack vs no school snack | NR | 5 months | Plasma ferritin Mean change 1 | favours control | p = 0.0001 |
| Arsenault 2009 | Observational | Colombia | 3202 Children enrolled in the public primary school system age 5-12 | School snack vs no school snack | NR | 5 months | Plasma vitamin B-12, Mean change 17 | favours control | p = 0.0001 |
| Ask 2010 | Controlled intervention | Norway | 150 School students | Free school lunch vs no free school lunch | NR | 4 months | Male BMI Intervention: baseline 20.7 (SD: 3.1); follow up 21.3 (SD: 3.3) Control: baseline 20.8 (SD: 2.9); follow up 21.2 (SD: 2.9) | favours control | p = 0.0001 |
| Ask 2010 | Controlled intervention | Norway | 150 School students | Free school lunch vs no free school lunch | NR | 4 months | Female BMI Intervention: baseline 20.7 (SD: 3.1); follow up 21.3 (SD: 3.3) Control: baseline 20.8 (SD: 2.9); follow up 21.2 (SD: 2.9) | favours control | p = 0.0001 |
| NiMurchu 2010 | Step wedge cluster RCT | New Zealand | 424 School age student | Free school breakfast vs no free breakfast | NR | 12 months | Food security (study child) OR 0.89 (95%CI: 0.7–1.18) p = 0.49 | favours control | p = 0.31 |
| Chen 2011 | Cohort | USA | 1723 Low income women | Food stamp participant vs non-participant | NR | NR | BMI Coefficient 0.201 (SE: 0.066) p = 0.0001 | favours control | p = 0.0001 |
| Leung 2011 | A cross-sectional analysis of the 2007 Adult California Health Interview Survey | USA | 7741 Adults in public assistance programs | People participating in food assistance programs vs non-participants | NR | NR | SNAP participants BMI Adjusted difference 1.08 (95%CI: 0.5–2.22) | favours control | p = 0.0001 |
| Leung 2011 | A cross-sectional analysis of the 2007 Adult California Health Interview Survey | USA | 7741 Adults in public assistance programs | People participating in food assistance programs vs non-participants | NR | NR | SNAP participants obesity (BMI ≥ 30.0kg/m2) Adjusted prevalence ratio 1.305 (95%CI: 1.1–1.5) | favours control | p = 0.0001 |
| Leung 2011 | A cross-sectional analysis of the 2007 Adult California Health Interview Survey | USA | 7741 Adults in public assistance programs | People participating in food assistance programs vs non-participants | NR | NR | SNAP participants obesity (BMI ≥ 30.0kg/m2) Adjusted prevalence ratio 1.305 (95%CI: 1.1–1.5) | favours control | p = 0.0001 |
| Leung 2011 | A cross-sectional analysis of the 2007 Adult California Health Interview Survey | USA | 7741 Adults in public assistance programs | People participating in food assistance programs vs non-participants | NR | NR | SNAP participants obesity (BMI ≥ 30.0kg/m2) Adjusted prevalence ratio 1.305 (95%CI: 1.1–1.5) | favours control | p = 0.0001 |
| Leung 2011 | A cross-sectional analysis of the 2007 Adult California Health Interview Survey | USA | 7741 Adults in public assistance programs | People participating in food assistance programs vs non-participants | NR | NR | SNAP participants obesity (BMI ≥ 30.0kg/m2) Adjusted prevalence ratio 1.305 (95%CI: 1.1–1.5) | favours control | p = 0.0001 |

(Continued)
Table 2. (Continued)

| Study | Study type | Country | Participants | Intervention vs. Comparison | Co-intervention | Time | Health Outcome | Results |
|-------|------------|---------|--------------|-----------------------------|----------------|------|----------------|---------|
| Jilcott 2011[52] | Cross sectional study: analyzed data from the 2005–2006 National Health and Nutrition Examination Survey | USA | 945 Food stamp eligible adults | Received food stamps vs no food stamps | NR | NR | BMI | Intervention follow-up: 30.5 (95% CI: 28.9–32.1) Control follow-up: 28.3 (95% CI: 27.5–29.2) P = 0.03, favouring control |
| | | | | | | | Waist circumference | Intervention follow-up: 98.4 (95% CI: 96.1–102.6) Control follow-up: 94.2–96.8 (95% CI: P = 0.06, favouring control |
| Nicholas 2011[53] | Analyze data from the Health and Retirement Study (HRS), a nationally representative, longitudinal survey of older Americans | USA | 558 Diabetic older adults | Received food stamps vs no food stamps | NR | NR | Food insufficient | Intervention: 0.27 (SD: 0.45) Control: 0.16 (SD: 0.34), favouring control |
| | | | | | | | HbA1c | Intervention: 7.22 (SD: 1.39) Control: 7.11 (SD: 1.5), favouring control |
| Schmeiser 2012[54] | Retrospective longitudinal study | USA | 16553 Low-income children | Participated in Supplemental Nutrition Assistance Program (SNAP) vs non-participants | NR | NR | BMI percentile girls | Number of past 60 months participating in SNAP (IV) Individual fixed-effects State fixed-effects: -0.3723; p < 0.01 |
| | | | | | | | Overweight girls | Number of past 60 months participating in SNAP (IV) Individual fixed-effects State fixed-effects: -0.0034; p = 0.4, favouring control |
| | | | | | | | Obese girls | Number of past 60 months participating in SNAP (IV) Individual fixed-effects State fixed-effects: -0.0011; p = 0.001, favouring control |
| | | | | | | | BMI percentile boys | Number of past 60 months participating in SNAP (IV) Individual fixed-effects State fixed-effects: -0.00574; p = 0.001 |
| | | | | | | | Overweight boys | Number of past 60 months participating in SNAP (IV) Individual fixed-effects State fixed-effects: -0.0078; p = 0.01 |
| | | | | | | | Obese boys | Number of past 60 months participating in SNAP (IV) Individual fixed-effects State fixed-effects: -0.0041; p = 0.001 |
| Leung 2013[55] | Multistage cross-sectional survey | USA | 5193 Low-income children | Participated in Supplemental Nutrition Assistance Program (SNAP) vs non-participants | NR | NR | Number of children overweight | Age and gender adjusted OR: 0.94 (95% CI: 0.7–1.29), favouring control |
| | | | | | | | Number of obese children | Age and gender adjusted OR: 1.31 (95% CI: 0.91–1.89), favouring control |
| Bere 2014[56] | Cluster randomized trial | Norway | 320 Children: 10- to 12-year-old children from 2 Norwegian counties | Free fruit vs no free fruit | NR | 96 months | BMI | Follow-up: intervention: 1.27 (95% CI: 0.9–1.76) Control: 1.35 (95% CI: 0.9–1.96) p = 0.1, favouring control |
| | | | | | | | Percent overweight | Follow-up: intervention: 1.5 (95% CI: 0.8–2.8) Control: 1.5 (95% CI: 0.9–2.6) p = 0.04 |

(Continued)
| Study          | Study type                                      | Country            | Participants | Intervention vs. Comparison | Co-intervention | Time | Health Outcome                  | Results* |
|---------------|------------------------------------------------|--------------------|--------------|-----------------------------|----------------|------|---------------------------------|----------|
| McMahon 2015  | Quasi-experimental regression discontinuity analysis | Ukraine            | 947 Children residing in the contaminated district after Chernobyl | 3 Free meals vs 2 free meals (uses same sample group for both intervention and control at different times) | NR             | NR    | Individual whole-body content of 137 Cesium adjusted for body weight (Bq/m²) | Spearman r = 0.26 p < 0.001 |
|               |                                                |                    |              |                             |                |      | Unspecified anemia (prevalence ratio) | Follow up: three meals 0.57 (95%CI: 0.48–0.67); Two meals 1.31 (95%CI: 1.11–1.57); p = 0.0001 |
|               |                                                |                    |              |                             |                |      | Allergy (prevalence ratio)         | Follow up: three meals 1.41 (95%CI: 0.86–1.93); Two meals 1.26 (95%CI: 0.92–1.93); p = 0.72 favour control |
|               |                                                |                    |              |                             |                |      | Atopic dermatitis (prevalence ratio) | Follow up: three meals 1.22 (95%CI: 0.65–2.14); Two meals 1.62 (95%CI: 0.58–4.82); p = 0.52 favour control |
|               |                                                |                    |              |                             |                |      | Bronchitis (prevalence ratio)      | Follow up: three meals 0.99 (95%CI: 0.81–1.48); Two meals 1.24 (95%CI: 0.91–1.69); p = 0.43 favour control |
|               |                                                |                    |              |                             |                |      | Common cold (prevalence ratio)     | Follow up: three meals 1.27 (95%CI: 0.85–1.84); Two meals 2.32 (95%CI: 1.79–3.0); p = 0.01 |
|               |                                                |                    |              |                             |                |      | Lymph node enlargement (prevalence ratio) | Follow up: three meals 1.01 (95%CI: 0.91–1.11); Two meals 1.07 (95%CI: 0.93–1.22); p = 0.84 favour control |
|               |                                                |                    |              |                             |                |      | Chronic tonsillitis/adenoiditis (prevalence ratio) | Follow up: three meals 0.91 (95%CI: 0.86–0.96); Two meals 0.93 (95%CI: 0.84–1.03); p = 0.52 favour control |
|               |                                                |                    |              |                             |                |      | Hemoglobin (g/dL)                  | Follow up: three meals 12.14 (95%CI: 12.05–12.22); and (95%): 12.65 (95%CI: 12.56–12.71); 2 meals beginning (1996): 12.46 (95%CI: 12.38–12.52) and (95%): 12.72 (95%CI: 12.66–12.79) unknown significance |
|               |                                                |                    |              |                             |                |      | BMI kg/m²                         | Follow up: three meals 17.22 (95%CI: 16.99–17.44); and (95%): 17.45 (95%CI: 17.27–17.63) 2 meals beginning (1996): 17.47 (95%CI: 17.34–17.60) and (95%): 17.78 (95%CI: 17.61–17.94) unknown significance |

*Results favor the intervention unless indicated otherwise

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study), New Zealand (one study), Ukraine (one study). One study (5-9%) involved a co-intervention consisting of nutrition and education counselling. [41] The most commonly measured health outcome was Body Mass Index (BMI) measured in 12 studies (70-6%). The study durations ranged from four to 96 months. Food studies reported a total of 73 outcomes, of which 28 were statistically significant, 41 were not significant, and significance was unknown for four outcomes. Of the 28 statistically significant outcomes, 22 outcomes (from eight different studies) favoured the intervention, and six outcomes (from three different studies) favoured the control group.

**Hygiene/Water sanitation.** There were 10 504 participants in the six hygiene or water sanitation studies (the household was the unit of analysis in two studies) (Table 3). The free

| Study          | Study type     | Country                  | Participants | Intervention vs Comparison                                                                 | Co-intervention                                                                 | Time   | Health Outcome                                                                 | Results*                                                                 |
|----------------|----------------|--------------------------|--------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Davies 2002   | RCT            | England                  | 3731 Children from the age of 12 months to 5-5 years | Free fluoride toothpaste vs no free toothpaste                                             | A leaflet was included with the packages                                        | 60 months | Decay-missing, and filled teeth index, Mean change 16%; p = 0.05                |                                                                              |
| Luby 2006     | Cluster RCT    | Pakistan                 | 1337 Households in squatter settlements           | 10 Neighborhoods received bleach, 9 neighborhoods received supplies for hand washing, 9 neighborhoods received flocculant-disinfectant, 10 neighborhoods received flocculant-disinfectant plus hand washing, 9 neighborhoods were control | NR                                              | 9 months | Diarrhoea daily longitudinal prevalence: bleach water treatment               | difference from control -55% (95%CI: -17-80)                                  |
| Livny 2007    | Cross-sectional study | Israel                  | 1500 infants                                      | Free tooth brushes and toothpaste vs no free good                                         | NR                                              | 48 months | 0 times brushed in the last 48 hours (percent of children with caries)       | intervention = 12; control = 24 unknown significance                           |
| Boisson 2013  | RCT            | India                    | 2163 Households with children under 5             | Free sodium dichloroisocyanurate tablets vs no free sodium dichloroisocyanurate tablets    | Intervention included a promotional campaign and instructions on how to use tablets | 13 months | Diarrhoea (longitudinal prevalence)                                          | Prevalence ratio 0.95 (95% CI: 0.79-1.3) favours control                     |
| Das 2013      | Cohort         | India                    | 93 Patients with filarial lymphoedema              | Free limb hygiene kit vs before receiving kit                                            | NR                                              | 12 months | Frequency of acute dermatolympangioadenitis: grade 1 (per year)               | Baseline 2.4; follow up 0.8 unknown significance                               |
|               |                |                          |                                                  |                                                                                            |                                                  |          | Frequency of acute dermatolymphangioadenitis: grade 2 (per year)              | Baseline 3.4; follow up 1.2 unknown significance                               |
|               |                |                          |                                                  |                                                                                            |                                                  |          | Frequency of acute dermatolymphangioadenitis: Grade 3 (per year)              | Baseline 4.8; follow up 1.8 unknown significance                               |

(Continued)
goods distributed were toothbrushes and toothpaste (two studies), a drinking water disinfectant (two studies), and free soap (two studies). The studies were conducted in India (three studies), England (one study), Pakistan (one study), and Israel (one study). Three studies (50%) involved a co-intervention which consisted of social marketing, and educational campaigns. [58–60] The most common outcomes were diarrhoea prevalence in three studies

### Table 3. (Continued)

| Study | Study type | Country | Participants | Intervention vs Comparison | Co-intervention | Time | Health Outcome | Results |
|-------|------------|---------|--------------|---------------------------|-----------------|------|----------------|---------|
| Nicholson 2014[60] | Cluster randomized controlled study | India | 1680 Households of children (5 years) and their families (the number of participants was not 100% clear) | Free soap vs no soap | Included a social marketing program aimed to educate, motivate and reward children for hand washing | ~10 months | Target children diarrhoea | Observed relative risk reduction 25.3% (95% CI: 36.6–2.3); p = 0.03 |
| | | | | | | | Target children Acute respiratory infections | Observed relative risk reduction 14.4% (95% CI: 29.6–8.3); p = 0.001 |
| | | | | | | | Children aged 5 and under (non-target) diarrhoea | Observed relative risk reduction 32.5% (95% CI: 41.1–3.8); p = 0.023 |
| | | | | | | | Children aged 5 and under (non-target) Acute respiratory infection | Observed relative risk reduction 20.5% (95% CI: 29.8–11.3); p = 0.001 |
| | | | | | | | Children aged 6–15 (non-Target) diarrhoea | Observed relative risk reduction 30.0% (95% CI: 38.7–6.6); p = 0.01 |
| | | | | | | | Children aged 6–15 (non-Target) acute respiratory infection | Observed relative risk reduction 11.8% (95% CI: 24.4–5.5); p = 0.003 |
| | | | | | | | whole families diarrhoea | Observed relative risk reduction 30.7% (95% CI: 37.5–5.5); p = 0.013 |
| | | | | | | | whole families acute respiratory infection | Observed relative risk reduction 13.9% (95% CI: 23.1–6.5); p = <0.001 |
| | | | | | | | Target children boils | Intervention: 2.87; Control: 3.86; p = 0.839 favourable control |
| | | | | | | | Target children ear infection | Intervention: 0.99; Control: 1.35; p = 0.114 favourable control |
| | | | | | | | Target children eye infection | Intervention: 0.38; Control: 0.7; p = <0.001 |
| | | | | | | | Target children headache | Intervention: 0.67; Control: 0.88; p = 0.227 favourable control |
| | | | | | | | Target children vomiting | Intervention: 1.07; Control: 1.22; p = 0.718 favourable control |
| | | | | | | | Whole families boil | Intervention: 1.84; Control: 1.65; p = 0.062 favourable control |
| | | | | | | | Whole families ear infection | Intervention: 0.65; Control: 0.79; p = 0.379 favourable control |
| | | | | | | | Whole families eye infection | Intervention: 0.62; Control: 0.8; p = 0.788 favourable control |
| | | | | | | | Whole families headache | Intervention: 2.98; Control: 2.58; p = 0.12 favourable control |
| | | | | | | | Whole families vomiting | Intervention: 0.92; Control: 0.84; p = 0.073 favourable control |

*Results favor the intervention unless indicated otherwise

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(50%); infection prevalence in two studies (33.3%); and prevalence of dental carries reported in two studies (33.3%). The study durations ranged from nine months to 60 months. These studies reported a total of 34 outcomes, of which 15 were statistically significant, 11 were not significant, and significance was unknown for eight outcomes. All of the 15 statistically significant outcomes (from three different studies) favoured the intervention.

**Insecticide treated nets (ITN).** There were 7661 participants in five studies providing ITN (Table 4). The studies were conducted in Cameroon (two studies), Ghana (one study), Kenya (one study), and Nigeria (one study). Three studies (60%) involved a co-intervention consisting of additional medical care, a social marketing campaign and preventative sulfadoxine-pyrimethamine treatment. [64–66] The most common outcomes measured were parasitaemia in three studies (60%); anemia in two studies (33.3%); malaria in two studies (33.3%). Other outcomes included mortality and birth weight. The study durations ranged from four months to 36 months. Eleven outcomes were reported, of which three were statistically significant, and eight were not. Of the three statistically significant outcomes (from three different studies), all favoured the intervention.

**Safety equipment.** Six studies provided free safety equipment including smoke alarms, hip protectors, mouth guards, and safety equipment for young children (e.g. stair gates and cupboard locks) (Table 5). We were unable to identify the total number of participants in these studies because some reports did not specify this information. The studies were conducted in England (two studies), USA (one study), Ireland (one study), Israel (one study) and Australia (one study). Five studies (83.3%) involved a co-intervention consisting of educational materials and sessions,[10, 69–71] as well as advice,[72] and one study offered stickers to promote the use of safety equipment.[71] The common outcome reported in all six studies was injury. Study duration ranged from six months to 72 months. Safety equipment studies reported a total of 23 outcomes, of which eight were statistically significant, 11 were not significant, and significance was unknown for four outcomes. Of the eight statistically significant outcomes, all eight outcomes (from three different studies) favoured the control and, according to the explanations provided in the articles, this may be been due to infrequent use of the safety equipment.[10, 71, 73]

**Miscellaneous.** Five studies involved a miscellaneous set of outcomes (Table 6). The distributed free goods included glucometer test strips for diabetic patients, glucometers, sunscreen, bus passes, and a mobile phone. Three studies (60%) involved a co-intervention consisting of a glucometer (intervention was test strips),[74] educational material and counseling (for the glucometer study) [75] as well as an automated message and calling card to reach participants’ primary care physicians (for the mobile phone study) [76]. The outcomes measured included HbA1c, blood glucose, triglycerides, Low Density Lipoprotein (LDL-C), Body Mass Index (BMI), waist circumference, rate of sunburns, and mortality rate. The study durations ranged from two months to 12 months. These studies reported 13 outcomes, of which three were statistically significant, eight were not significant, and significance was unknown for two outcomes. All three statistically significant outcomes (from two different studies) favoured the intervention.

**Results by health outcome**

In addition to analyzing the results of studies categorized by type of free good distributed to participants, we combined results from the reviewed studies for the health outcomes of mortality and diarrhea because these two outcomes were reported in studies of different categories of goods.

**Mortality.** Mortality was reported as a health outcome in three studies of mosquito nets (one study), housing vouchers (one study), and mobile phones (one study) including 17,730
participants. The first study gave families with children under five an insecticide treated insect net in Kenya. The study found that receiving a mosquito net was a significant predictor of reduced mortality (rate ratio: 0.56; 95% confidence interval (CI): 0.33–0.96). The second study gave a housing voucher to families of children living in public housing in the USA. Receiving a housing voucher was not a significant predictor of mortality in any of the 3
Table 5. Characteristics of included safety equipment studies (N = 6).

| Study            | Study type            | Country       | Participants                                                                 | Intervention vs Comparison                                                                 | Co-intervention                                                                                                                                                                                                 | Time      | Health Outcome                                                                                      | Results*                                                                                     |
|------------------|-----------------------|---------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Mallonee 2000    | Community intervention trial- pre and post design | USA           | 9291 Homes in the Oklahoma city area                                           | Free smoke alarm vs no free smoke alarm                                                                                                           | Were given written educational material, and periodic fire alarm tests to ensure distributed alarms were functioning correctly                                                                                  | 72 months | Injury rates per 100 residential fires                                                                 | Intervention = baseline 5-02, follow up 1-2; Control = baseline 1-95, follow up 2-19; unknown significance |
| DiGuiseppi 2002  | Cluster RCT           | England       | Mean of 8191 primarily households including elderly people or children          | Free smoke alarm vs no free smoke alarm                                                                                                           | Smoke alarms were given with a fitting, educational brochures, and installation upon request                                                                                                                     | 37 months | All injuries                                                                                       | Rate ratio = 1.3 (95% CI: 0.9 - 1.8) favours control                                                                                       |
| O’Halloran 2004  | Cluster RCT           | Ireland       | Residents from 127 Nursing homes (~4117 residents)                             | Given hip protectors vs no hip protectors                                                                                                           | A 1 hour information session was conducted with nursing home staff and support was given to nursing staff to implement this program, as well as posters and stickers promoting the use of hip protectors | 18 months | Number of hip fractures (rate per 100 occupied beds)                                                                 | Unadjusted rate ratio = 1.05 (95% CI: 0.76 - 1.45) favours control                                                                 |
| Watson 2005      | RCT                   | England       | 3428 Families of children younger than 5                                      | Intervention received free or low cost safety equipment (Fitted stair gates, fire guards, smoke alarms, cupboard locks, and window locks) vs usual care | Provided a consultation/advice                                                                                                                                                                             | 24 months | Child in family had a medically attended injury                                                                 | OR 1.14 (95% CI: 0.98 - 1.5) favours control                                                                                                 |
| Zadik 2009       | Retrospective study   | Israel        | Infantry units in the Israel Defense Forces (630 participants)                | Intervention received boil an bite mouth guards vs control receiving none                                                                     | NR                                                                                                                                                                                                             | NR        | Number of sports related oro-facial traumas                                                                 | Intervention: 38/272; Control: 31/358; p < 0.05 favours control                                                                                |
|                  |                       |               |                                                                                |                                                                                                                                            |                                                                                                                                                                                                              |           | Dental fractures                                                                                   | Intervention: 25/272; Control: 17/358; p < 0.001 favours control                                                                            |
|                  |                       |               |                                                                                |                                                                                                                                            |                                                                                                                                                                                                              |           | Dental luxations/ subluxations                                                                       | Intervention: 4/272; Control: 4/358 favours control                                                                                      |
|                  |                       |               |                                                                                |                                                                                                                                            |                                                                                                                                                                                                              |           | Lip laceration                                                                                     | Intervention: 16/272; Control: 7/358; p < 0.001 favours control                                                                          |
|                  |                       |               |                                                                                |                                                                                                                                            |                                                                                                                                                                                                              |           | Chin laceration                                                                                     | Intervention: 8/272; Control: 5/358; p < 0.05 favours control                                                                           |
|                  |                       |               |                                                                                |                                                                                                                                            |                                                                                                                                                                                                              |           | Dislocation and/or pain of TMJ                                                                      | Intervention: 6/272; Control: 1/358; p < 0.001 favours control                                                                           |
|                  |                       |               |                                                                                |                                                                                                                                            |                                                                                                                                                                                                              |           | Fracture of mandible                                                                               | Intervention: 0/272; Control: 1/358; p < 0.001 favours control                                                                           |

(Continued)
categories; deaths from disease ($p = 0.84$), deaths by homicide ($p = 0.81$), and accidental deaths ($p = 0.19$). [24] The final study gave phones to pregnant women in Zanzibar. [76] Mortality was recorded in three ways: stillbirth (unadjusted odds ratio (UOR): $0.62; 95\%$CI: $0.31–1.22$), perinatal mortality (UOR: $0.49; 95\%$CI: $0.27–0.90$), and neonatal mortality (UOR: $0.85; 95\%$CI: $0.37–1.95$). Receiving a free phone significantly reduced perinatal mortality. [76]

**Diarrhea.** Diarrhea was reported as a health outcome in four studies of food (one study), and hygiene and water sanitation (three studies), which included 8382 participants. The first study conducted in Pakistan included households in squatter settlements receiving either bleach, hand washing supplies, flocculant-disinfectant, or flocculant-disinfectant plus hand washing. [61] The authors concluded that receiving any of the free goods, as well as the intense community-based intervention, which included meetings and presentations to community leaders and residents about the importance of hygiene and water contamination, reduced the daily longitudinal prevalence of diarrhoea; however, the level of statistical significance was not reported. [61] The second study, conducted in Colombia, gave primary school children a school snack. [47] The authors found that the rate of days per child year of diarrhoea (unadjusted rate ratio (URR): $0.68; CI: 0.63–0.73$), and diarrhoea with vomiting (URR: $0.63; CI: 0.52–0.75$) were significantly reduced with the provision of a school snack. [47] The third study, conducted in India, gave children under the age of five sodium dichloroisocyanurate tablets. [59] The authors found that the longitudinal prevalence of diarrhoea for children given sodium dichloroisocyanurate tablets was not significantly different from the control (prevalence ratio: $0.95; CI: 0.79–1.13$). [59] The final study, conducted in India, distributed soap to households with children under five, and outcomes were assessed for the target children, as well as their family, including siblings. [60] The authors reported significant relative risk reductions (RRR) in diarrhoea prevalence related to the provision of free soap among four groups: target children (RRR: $25.3\%; CI 36.6–2.3$); children aged five and under (non-target) (RRR: $32.5\%; CI 41.1–3.8$); children aged six-15 (non-target) (RRR: $30\%; CI 38.7–6.6$); and whole families (observed RRR $30.7\%; CI 37.5–5.5$). [60] As such, three of the four studies reported that diarrhoea was significantly reduced with the provision of free goods.

**Interpretation**

The results of this systematic review provide evidence that free goods can improve health outcomes in certain circumstances, although there are also important gaps and limitations in the
Table 6. Characteristics of included other studies (N = 5).

| Study          | Study type          | Country      | Participants | Intervention vs Comparison | Co-intervention | Time     | Health Outcome | Results*                                      |
|---------------|---------------------|--------------|--------------|-----------------------------|-----------------|----------|----------------|----------------------------------------------|
| Nyomba 2004[74] | RCT                 | Canada       | 62 Diabetics | Received test strips for their free glucometer vs no free test strips for free glucometer | Both groups received a free glucometer | 12 months | HbAC1c         | p = < 0.002<br>Random blood glucose measured at each doctor visit p = < 0.005 |
| Nicol 2007[77]   | Three-arm prospective randomized trial | France       | 364 People staying at beach resorts | Free sunscreen vs no free sunscreen | NR | 2 months | Sunburn during the week in the free sunscreen group vs control | Intervention 29.9%; Control 46.8% favours control<br> Sunburn during the week in the free new labelled sunscreen group vs control | Intervention 21.2%; Control 46.8% favours control |
| Webb 2012[78]    | Longitudinal design | England      | Elderly residents | Intervention received a free bus pass, control was not eligible | NR | NR | BMI | mean change: Intervention: 0.22 (95% CI: 0.15–0.28)<br> Control: 0.6 (95% CI: 0.43–0.77) unknown significance |
|                 |                     |              |              |                             |                 |          | Waist circumference | mean change: Intervention: 1.65 (95% CI: 1.47–1.83)<br> Control: 2.17 (95% CI: 1.7–2.64) unknown significance |
| Guo 2014[75]     | RCT                 | China        | 132 Low income with type 2 diabetes | Received glucometers vs no free glucometers | education materials and counseling were provided to all groups | 6 months | HbA1c | Overall difference between groups based on one-way ANOVA = -0.13 (95% CI: -0.38–0.12); p = 0.29 (favours control) |
|                 |                     |              |              |                             |                 |          | BMI | Overall difference between groups based on one-way ANOVA = 0.05 (95% CI: -0.34–0.44); p = 0.79 (favours control) |
|                 |                     |              |              |                             |                 |          | Triglycerides | Overall difference between groups based on one-way ANOVA = -0.14 (95% CI: -0.45–0.18); p = 0.39 (favours control) |
|                 |                     |              |              |                             |                 |          | LDL-C | Overall difference between groups based on one-way ANOVA = -0.01 (95% CI: -0.15–0.16); p = 0.92 (favours control) |
| Lund 2014[76]     | Cluster RCT         | Zanzibar     | 2550 Pregnant women | Received mobile phone vs no free mobile phone | There was an automated short message component in addition to the intervention | NR | Still birth | Unadjusted odds ratio 0.62 (95% CI: 0.31–1.22) favours control |
|                 |                     |              |              |                             |                 |          | Perinatal mortality rate | Unadjusted odds ratio 0.49 (95% CI: 0.27–0.9) |
|                 |                     |              |              |                             |                 |          | Neonatal mortality rate | Unadjusted odds ratio 0.85 (95% CI: 0.37–1.95) favours control |

*Results favor the intervention unless indicated otherwise

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existing literature. Housing provision for people with serious mental health conditions in high-income countries and food provision to low-income children in high-income countries are supported by the largest number of studies. Of the 59 reviewed studies involving 379 932
participants (most were individuals but some were households) that examined the health effects of free goods, the most commonly studied free goods were housing (20 studies) and food (17 studies). Among the 268 total outcomes reported, the most commonly reported outcomes were housing retention in 12 housing studies and BMI in 12 food studies. Four RCTs were deemed to be unclear or at high risk of bias, and one non-RCT was rated as serious, critical or no information, in all risk of bias categories. Therefore, overall the studies were of medium to high quality in terms of bias. Among the studies included in this review, 80 health outcomes were statistically significant favouring the intervention, 19 health outcomes were statistically significant favouring the control, 141 health outcomes were not significant, and significance was unknown for 28 health outcomes.

The rationale underpinning how the provision of free tangible goods impacts health was typically not stated in the reviewed studies. However, we identify four related concepts that help us understand the rationale for providing free tangible goods. First, facilitating access to a good that is capable of promoting health should promote health unless there are unintended negative effects or implementation problems. We did in fact find some studies where those receiving a free good had worse health outcomes (e.g. hip protectors were associated with an increased risk of hip fractures).[71] Second, if poverty is defined, at least partially, as being unable to afford tangible goods (and services) in a market-based economy,[79] then studies examining the impact of free good provision on health describe the effect of poverty reduction on health. Findings from these studies could then be considered alongside studies of other interventions aimed at reducing poverty, such as a basic income as a complementary approach to reducing poverty.[12, 13] Third, the free provision of goods could be understood as "non-cash" income that is valued similar to its cash equivalent after being appropriately discounted.[6] Fourth, having certain tangible goods can be understood as fulfilling a basic human right (e.g. the right to adequate housing, the right to adequate nutrition and clean water).[80] The provision of such goods could be seen as achieving social justice and could have positive impacts not only for individuals but also for their communities.

Comparison with prior studies

To the best of our knowledge this is the first systematic review to examine a wide range of free tangible goods and their effects on health. One recent systematic review and narrative analysis of 31 Housing First studies found mixed results for the impact of providing free housing for substance abuse and psychiatric symptoms, a clear benefit for housing stability, and a benefit for quality of life. These findings generally align well with ours.[81]

A number of studies have examined whether people who were given free goods use them or resell them. One such study conducted among pregnant women and households with young children in Uganda, for example, investigated this concept with the provision of free long-lasting insecticide treated mosquito nets. [82] This study assessed the willingness to pay for a mosquito net and willingness to sell a mosquito net given for free by simulating market exchanges. Seventy-three percent of people who received free nets were unwilling to accept the maximum price offered to part with even one of their nets. [82] Most people who were given free nets were not likely to resell their nets and in fact did use them for their intended purpose. [82]

Other studies have investigated using financial investments to complement health interventions and further improve health outcomes. A non-randomized controlled assessment from sub-Saharan Africa, in which simultaneous investments were made in agriculture, the environment, business development, education, infrastructure, and health in rural village sites with high baseline levels of poverty and under nutrition, found that mortality rates in young
children decreased by 22% in study sites relative to baseline.\[83\] Reductions in poverty, food insecurity, stunting, and malaria parasitemia were also reported in study sites. \[83\]

**Strengths and limitations of our study**

Due to the great variety of free goods with potential to impact health, the design of a search strategy was challenging and we may have inadvertently omitted some key search terms. The wide array of interventions and outcomes meant that we could not perform a meta-analysis of results. The broad approach allowed us to include an interesting array of studies of different free tangible goods. Some studies involved co-interventions (e.g. almost all housing studies involved other supports in addition to free housing) and this limits the ability to determine whether the free good or the co-intervention affected health outcomes. We also excluded many studies that provided free tangible goods, including clean needles, condoms, and baby cribs, but did not report a health outcome. The literature may be biased towards studies of items with a less certain benefits. In other words, researchers may have decided not to study certain goods which are very likely to be beneficial (e.g. condoms, clean needles) and some such studies may not be ethical (i.e. it may be difficult to study the free provision of an item that is very likely to be beneficial). Some of the Housing First studies were overlapping as different reports included some of the same participants and some of the same outcomes, so we attempted to strike a balance between not excluding results and not counting the same results twice.

**Conclusions and future work**

Findings of this systematic review suggest that providing free tangible goods can promote health in certain circumstances. Additional high-quality studies of different goods are needed. Future work should also focus on the contexts in which free goods are most beneficial and explicitly state the theory or theories underpinning each study or intervention.

**Supporting information**

S1 Checklist. PRISMA checklist.
(DOC)

S1 File. Search strategy.
(DOCX)

S1 Table. Cochrane risk of bias assessment.
(DOCX)

S2 Table. ROBINS 1 risk of bias assessment.
(DOCX)

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Author Contributions

Conceptualization: Nav Persaud, Andrew Pinto.

Data curation: Nav Persaud, Liane Steiner, Hannah Woods, Gurleen Chahal.

Formal analysis: Nav Persaud, Liane Steiner, Hannah Woods.

Investigation: Nav Persaud, Liane Steiner, Hannah Woods, Andrew Pinto.

Methodology: Nav Persaud, Liane Steiner, Hannah Woods, Stephen Hwang, Andrew Pinto.

Project administration: Nav Persaud.

Supervision: Nav Persaud.

Validation: Nav Persaud, Liane Steiner, Hannah Woods, Tatiana Aratangy, Susitha Wanigaratne, Jane Polsky, Stephen Hwang, Gurleen Chahal, Andrew Pinto.

Writing – original draft: Nav Persaud, Liane Steiner, Hannah Woods.

Writing – review & editing: Nav Persaud, Liane Steiner, Hannah Woods, Tatiana Aratangy, Susitha Wanigaratne, Jane Polsky, Stephen Hwang, Gurleen Chahal, Andrew Pinto.

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